Modelling a conversational agent (Botocrates) for promoting critical thinking and argumentation skills

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Submitted in accordance with the requirements for the degree of

Doctor of Philosophy

The University of Leeds

School of Education

February 2017

The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

Acknowledgements

I would like to express my profound gratitude and special appreciation to all the people who helped me to accomplish this thesis.

Aisha Walker and James Simpsons have been perfect supervisors. Undoubtedly, without the guidance and advice offered by my supervisors, I would not have been able to complete this work. Aisha and James, thank you very much for all your support and assistance.

Special thanks to all the students who participated in the study, and to my fellow mate Felix who played the role of the wizard during the evaluation stage. This study could not have been accomplished without their efforts.

I would also like to extend my deepest gratitude to the staff and students at the School of Education at the University of Leeds for providing me with an ideal learning environment during my doctoral study.

Finally, I wish also to express my sincere gratitude to all my family members and my friends for their support and encouragement.

Abstract

Students in higher education institutions are often advised to think critically, yet without being guided to do so. The study investigated the use of a conversational agent (Botocrates) for supporting critical thinking and academic argumentation skills. The overarching research questions were: can a conversational agent support critical thinking and academic argumentation skills? If so, how?

The study was carried out in two stages: modelling and evaluating Botocrates' prototype. The prototype was a Wizard-of-Oz system where a human plays Botocrates' role by following a set of instructions and knowledge-base to guide generation of responses. Both stages were conducted at the School of Education at the University of Leeds.

In the first stage, the study analysed 13 logs of online seminars in order to define the tasks and dialogue strategies needed to be performed by Botocrates. The study identified two main tasks of Botocrates: providing answers to students' enquiries and engaging students in the argumentation process. Botocrates’ dialogue strategies and contents were built to achieve these two tasks. The novel theoretical framework of the *‘challenge to explain’* process and the notion of the *‘constructive expansion of exchange structure’* were produced during this stage and incorporated into Botocrates’ prototype. The aim of the ‘*challenge to explain’* process is to engage users in repeated and constant cycles of reflective thinking processes. The *‘constructive expansion of exchange structure’* is the practical application of the *‘challenge to explain’* process.

In the second stage, the study used the Wizard-of-Oz (WOZ) experiments and interviews to evaluate Botocrates’ prototype. 7 students participated in the evaluation stage and each participant was immediately interviewed after chatting with Botocrates. The analysis of the data gathered from the WOZ and interviews showed encouraging results in terms of students’ engagement in the process of argumentation. As a result of the role of ‘critic’ played by Botocrates during the interactions, users actively and positively adopted the roles of explainer, clarifier, and evaluator. However, the results also showed negative experiences that occurred to users during the interaction. Improving Botocrates’ performance and training users could decrease users’ unsuccessful and negative experiences. The study identified the critical success and failure factors related to achieving the tasks of Botocrates.

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Abbreviations

AAB	–	Academic Argumentation Bank
AAE	–	Academic Argumentation Engine
AI	–	Artificial Intelligence
AIML	–	Artificial Intelligence Mark-up Language
CA	–	Conversation Analysis
Close-C2E	–	Close-Challenge to Explain move
CMC	–	Computer Mediated Communication
CT	–	Critical Thinking
DA	–	Discourse Analysis
DM	–	Dialogue Manager
ESA	–	Exchange Structure Analysis
Ex-St-Opener	–	Exchange structure Opener move
HCD	–	Human Centred Design
HCI	–	Human- Computer Interaction
HHI	–	Human- Human Interaction
HTML	–	HyperText Markup Language
I	–	Initiate turn
ICT	–	Information Communications Technology
II	–	Ill-informed turn
INI	–	Input Identifier
KB	–	Knowledge Base
N	–	Neutral turn
NL	–	Natural Language
NLP	–	Natural Language Processing
OUG	–	Output Generator
PD	–	Persuasive Dialogue
PM	–	Persuasion Machine
R	–	Respond turn
RC	–	Response-Complement turn
RI	–	Re-Initiate turn
SA	–	Stand Alone turns
SCMC	–	Synchronous Computer Mediated Communication
STB	–	SINCE, THEN and BECAUSE
TM	–	Task Manager
UCD	–	User Centred Design
VLE	–	Virtual Learning Environment
WOZ	–	Wizard of Oz Experiment

Chapter One: Introduction

The aim of this chapter is to provide readers with a clear and comprehensive overview of the work presented in this thesis. This chapter describes the focus of the research project and the topic being investigated within the scope of my study. This chapter is divided into seven sections aiming at introducing the key components of this study. The first section aims to explain the aim of the study. The second section presents an opening statement to the research study. The third section defines the research questions. In the fourth section, I share with the readers the story that inspired and motivated me to pursue the goal of this research. The location and the context of the study are described in the fifth section. The sixth section clarifies the significance of the study. The final section outlines the entire structure of the presented work throughout this thesis.

1.1 The aim of the study

The aim of the study is to explore the possibility of using a conversational agent for supporting critical thinking and academic argumentation skills. To this end, the study is intended to build a prototype of a conversational agent (Botocrates) that could promote students' critical thinking and academic argumentation skills. The prototype was a Wizard-of-Oz system where a human plays Botocrates' role by following a set of instructions and knowledge-base to guide generation of responses. The prototype of the agent is created to simulate the brain of an 'ideal critical thinker' who aims to engage users in reflective thinking. By doing so, the agent is utilized as a scaffolding device for supporting students' skills of constructing, evaluating and analysing arguments. The purpose of modelling Botocrates is to provide students with a platform where the internalisation of academic argumentation processes could be achieved through interactions. The study was conducted in two stages: a) the analytical stage (modelling Botocrates' prototype), and b) the experimental stage (evaluating Botocrates' interaction process). The aim of the first stage is focused on identifying the distinctive characteristics and attributes of Botocrates that could achieve the ultimate goal of the design. Specifying Botocrates' intellectual behaviours including the tasks, sub-tasks and dialogue strategies helps in modelling an initial prototype of Botocrates. The second stage aims to evaluate the simulation prototype of Botocrates. The evaluation process is designed to take into account both evaluating the outcomes of the interactions between Botocrates and users, and evaluating Botocrates' responses from users' perspectives. Modelling an early sample of Botocrates and testing its usability can offer us a better understanding of whether a conversational agent could be employed for supporting students' critical thinking and academic argumentation skills or not, and if so, how?

The origin of the name of the agent 'Botocrates' comes from a combination of 'Socrates', who is known as the most outstanding philosopher in the field of critical thinking, and the name of the computer system that interacts with users in natural language 'chatbot'.

1.2 Introduction

Critical thinking and academic argumentation are central concepts that determine students' success and achievement in higher education institutions (Schreiner, 2009, Pike, 2011). Despite the fact that students are often encouraged to be more critical in order to obtain higher marks (in, for example, feedback on assessed work), it has been suggested that they are not given adequate instructions on how to think critically (Halpern, 2003, Andrews, 2010). Tutors in higher education systems seem to be more interested in the outcomes of students' works without giving consideration to the process of students' cognitive development. Several authors point out that students lack the abilities to judge and evaluate the information in a careful and critical manner (Browne, 2000, Bok, 2008, Llewellyn, 2013, Wisdom, 2015). In this respect, Harris (2014) states that

> Regardless of who is to blame for students' lack of critical thinking skills, it is clear that our students need to develop this skill in order to meet the expectations.
>
> (Harris, 2014, p.64)

Focusing on promoting students' cognitive abilities should be one of the fundamental goals of higher education systems, because it is seen as a key factor that enables students to succeed in their programs and beyond that, in their professional careers (Paul and Elder, 2006a, Blömeke et al, 2013, Bringle et al, 2013, Hoidn, 2016). Higher education institutions should provide students with the opportunities to develop their own thinking skills (Siddiqui, 2004). Helping students to promote their critical thinking skills requires learning activities that could lead to the development of their cognitive abilities (Schwarz, 2009, Freeley and Steinberg, 2013). The emphasis here should be given to the long-term better practice that could help students in developing their intellectual skills. Critical thinking and academic argumentation skills are not a prepared or ready-made package that could be acquired and applied overnight, but on the contrary the acquisition of such skills occurs during routine practice (Kuhn, 1991, Kuhn and Felton 1997, Kuhn and Udell 2003, Mercer, 2003, Pilkington and Walker 2003c, Kuhn, 2009b, Ravenscroft and McAlister, 2006a, Ravenscroft and McAlister, 2006b, Schwarz, 2009, Baker, 2009).

The development of students' cognitive skills and their intellectual behaviours is a gradual process obtained through repeated collaborative interactions (Jordan et al, 2008, Coch et al, 2010, Hagen and Jordan, 2011, Kuhn et al, 2015). Vygotsky's theory of cognitive development (1978) suggests that dialogue contributes to the development of students' cognitive abilities. Kuhn (1991) argues that students' engagement in dialogue leads to developing their thinking strategies. The process of dialogue and interaction can foster and shape students' mental models of thinking (Jenlink et al, 2007). Therefore, there is a need to design activities that enable students to be engaged in meaningful dialogues (Bento, 2004, Crawford, 2005, Chesters, 2012). However, not all types of interaction can promote students' critical thinking skills (Mercer, 1995). In order to foster students' critical thinking skills, the interaction should stimulate reflective thinking (Fisher, 2001). The development of students' critical thinking skills requires a type of interaction that allows a constructive conflict to take place (Garton, 2008, Chipman and Meyrowitz, 2012).

In the past, the opportunities of students to be engaged in dialogue typically were limited to the availability of their instructors and their peers. Moore (1993) identifies three types of interaction that occur in online learning environments: a) interaction with the content, b) interaction with instructors and c) interaction with other learners. It can be noticed that Moore (1993) did not take into account the interaction with a conversational agent or a chatbot because it was not utilized for educational purposes at the time of his classification. Due to the huge development in the field of human to computer interaction (HCI), the interaction with computers in natural language dialogue becomes possible. Conversational agents are computer programs that enable users to be engaged in natural language communication. Chatbot is the type of conversational agent designed to interact with users through text or voice.

However, most of the existing chatbots were created to perform simple interactions. The simplicity or the sophistication of interaction depends on the level of task complexity carried out by the agent (Jurafsky and Martin, 2009). Using a conversational agent for promoting critical thinking and academic argumentation skills is seen as a complex task, which aims to extend the benefits of these tools beyond the performance of simple tasks such as entertainment or information retrieval (Andrews and Quarteroni, 2011). Students' engagement in argumentative interactions with the agent is complicated because of the nature of the argumentation process, which requires complex decision-making processes (D'errico et al, 2015). The process of argumentation might include more than a single reply (Scheuer et al, 2012). It is dynamic and the sequence of moves during the interaction should take into account different interactional behaviours (Walton, 2006). Thus, the dialogue strategies adopted by the agent have to be carefully designed in order to achieve the specific goal of interaction (Chen and Jokinen, 2010, Bunt, 2013b, Nishida et al, 2014).

When a conversational agent is used to perform a certain task, such as promoting critical thinking and academic argumentation skills, it is classified as a task-oriented agent (Pietquin, 2004). At the early stage of creating a task-oriented agent, the designer has to identify the tasks that need to be performed by the agent (Wang and Nakatsu, 2013, Kane, 2016). This early stage of creating the agent can be seen as analytical because the focus remains on understanding users and tasks (Gould and Lewis, 1985). By the end of the analytical stage, the first prototype of the agent can emerge. A prototype here refers to the early version of the design that represents the actual work of the agent (Cassell, 2000). Building an initial prototype is followed by an experimental stage in which the prototype is tested with the potential users in a simulated environment. The real use observation phase enables the developer to evaluate the usability of the new system (Williams, 2004, Mihailidis and Bardram, 2006). Before integrating the prototype into the components of the dialogue system, the experimental stage and iterative improvements must continue until the final version of the prototype achieves the ultimate goal of the design (Jacko and Stephanidis 2003, Wang, 2013).

1.3 Research Questions

The purpose of my research is translated into two overarching questions:

Can a conversational agent (Botocrates) support critical thinking and academic argumentation skills? If so, how?

In order to achieve the final target of reaching the answer to the overarching questions, the study is designed to address a set of sub-questions that reflect the two stages of conducting the study. The sub-questions of each stage are directly connected to the research objectives.

Stage one: Modelling Botocrates' prototype

The key question of this stage is:

What should go into the agent's 'brain' that is likely to promote critical thinking and academic argumentation skills?

The agent's brain here refers to the dialogue strategies and dialogue content needed for completing the tasks.

The first stage is guided by the following sub-questions:

- Sub-question 1: What are the tasks and sub-tasks needed to be performed by Botocrates when conversing with users?
- Sub-question 2: What are the dialogue strategies and tactics of Botocrates that could help in achieving the final goal of interaction?
- Sub-question 3: How can Botocrates' domain of knowledge support the implementation of Botocrates' intellectual conversational behaviours?

a) *Stage two: evaluating Botocrates' prototype*

The key question of this stage is:

What happens when learners interact with Botocrates?

The second stage is guided by the following sub-questions:

- Sub-question 1: Does Botocrates succeed in performing the tasks of interaction including users' engagement in the argumentation process? If so, how?
- Sub-question 2: How do students feel when chatting with Botocrates?

The research objectives and their justifications are illustrated extensively in chapter 4, section *4.2 Research Objectives & Questions*.

1.4 The starting point of the study (my personal motivation for the study)

The idea of doing my research in the area of critical thinking and academic argumentation came as a result of the successful experiences that I had when studying the MA ICT in Education course at the University of Leeds. Learner-centred approach, assessment for learning, shifting from instruction to construction classroom, social learning environment and collaborative learning are some examples of the positive experiences that led me to choose the topic of my study. In my opinion, the main fruitful and meaningful activities that inspired me to carry out my research about critical thinking and argumentation are reflective activities. Our tutor was continuously inviting my fellow classmates and me to reflect on our experiences with the modules that we enrolled in. During the reflective activities, I was asked to carefully analyse and evaluate my own learning practices. The evaluation process of my own learning activities contributed positively to my engagement in the process of learning as an active member. Reflection activities enabled me to be meta-cognitively engaged (Keeton et al, 2002, Godinho and Wilson, 2013, Major et al, 2015). I could say that metacognitive activities (thinking about my own thinking) encouraged me to think about what I was doing and more importantly how to improve my learning process (Gibbons, 2002, Ebersohn and Eloff, 2004, Wong, 2011).

As a result of being engaged in such activities, I noticed that most of the outcomes of our interactions that my colleagues and I were engaged in during online seminars can be described as cumulative discourses. A cumulative discourse occurs when students construct common knowledge in a cumulative way. In such discourses students accept and agree with their peers' contributions in an uncritical manner, which can be characterised by the lack of careful evaluations and reasonable judgment of their peers' ideas (Mercer, 1995). As a consequence of this evaluation, I asked myself: how can I contribute to improving students' discussions to be more exploratory ones? Exploratory interaction happens when students are actively engaged in critical and meaningful dialogue where their ideas are challenged, justified and defended (Mercer, 1995). Supporting students' critical thinking and argumentation skills can shift the interactions to be more exploratory (Mercer and Littleton, 2007).

I would like to explain here why chatbots can be useful as an alternative to human teachers or peers. The use of chatbots for educational purposes could foster further teaching and learning experiences. Abu Shawar and Atwell (2007a & 2007c) report some potential advantages of the use of chatbots. For example, in the area of language learning, users found chatbots interesting and enjoyable tools for practicing the target language (Abu Shawar and Atwell, 2007a). Abu Shawar and Atwell (2007c) point out that chatbots can enhance language learner autonomy because they provide learners with an opportunity for independent and active learning. Jia (2004) suggests that chatbots can be used as tools for learning English as a foreign language. Other similar studies highlight the benefits of using conversational agents for language learning (Seneff, 2006, Fryer and Carpenter, 2006, De Gasperis and Florio, 2012, Jia, 2014), mathematics (Stahl et al, 2010) and medical education (Kerfoot et al, 2006). The logs generated from the interaction between the system and students can be used to evaluate and assess the learning process by identifying students' areas of weakness (Knill et al, 2004).

Chatbots also can be used as a scaffolding device by bridging the gap between users' knowledge and their practices (Lehtinen, 2008, Chaudhuri et al, 2009, Stahl et al, 2010). Haake and Gulz (2009) suggest that chatbots are useful tools for coaching and motivation in the learning process. Some other advantages of using chatbots to fulfil pedagogical purposes include the ability of the agent to interact with learners without time constraints (as is the case with any software system, in that the agent does not become bored or tired) (Fryer and Carpenter, 2006) and their availability online from anywhere at anytime (Lehtinen, 2008). Kim et al (2002) propose that chatbots can be utilised to support e-learning. Wallace et al (2003, p.1) state, "We can imagine chatterbots acting as talking books for children, chatterbots for foreign language instruction, and teaching chatterbots in general". Note that the rationale for using chatbots in education is further explored in chapter 2, section *Conversational agents for educational purpose,* page 50.

1.5 Location and Context of the Study

The study took place in the School of Education at the University of Leeds. The participants in the study were the students who enrolled in the MA ICT/ELT in Education course. The MA ICT/ELT in Education programme is provided and taught online. The course allows students to gain experiences about the use of digital technologies in education. The learning activities are designed to cover a wide range of issues relating to the use of technology in enhancing the learning process across a variety of educational settings and pedagogical interactions. The programme is also intended to enable students to obtain practical experience of the design and the evaluation of learning materials for e-learning environments. Students who enrolled in the programme use a Virtual Learning Environment (VLE) to work with their tutors and peers cooperatively and collaboratively. In addition, the use of the VLE and the University Portal allow students to gain access to learning resources including modules' materials and the electronic library of the University of Leeds anytime from anywhere. The modules of the programme are taught using both synchronous and asynchronous online communications. The synchronous online seminars are text-based and based on academic publications and research papers related to the weekly topics. The online seminars are held via the Adobe Connect platform provided within the VLE. The MA ICT/ELT in Education programme consists of both home and overseas students who study either full-time or part-time. The research sites and participants in this research are thoroughly introduced in chapter 4, section *4.3 Research Site & Participants*.

1.6 The significance of the study

There are two primary levels of significance attributed to the aim of the study. First, the research is intended to contribute theoretically and practically to the field of critical thinking and academic argumentation. Botocrates could bring a new understanding to the field regarding the process of promoting students' critical thinking and academic argumentation skills. Second, although conversational agents have been used in different domains and various contexts (Kerly et al, 2006, Quarteroni and Manandhar, 2007, Abu Shawar and Atwell, 2007, Zakos and Capper, 2008, O'Shea et al, 2010, Augello et al, 2012, Kuligowska, 2015), employing conversational agents for such a pedagogical purpose could be described as a little-known educational practice. This research could establish the baseline for a new intervention for promoting critical thinking skills. The research highlights the need for considering a new area and concept, previously not explored in adequate detail, which possibly could lead to better practice in teaching and learning (Ross, 2005, Fitzpatrick et al, 2012).

1.7 Thesis Outline

The overall structure and the organisational patterns of the thesis are divided into eight chapters. The following subsections give the readers a brief overview of the content and the purpose of each chapter.

Chapter One: Introduction

The purpose of the first chapter is to provide readers with a general review of the research. This chapter comprises seven subsections: the aim of the study, the introductory statement, research questions, the starting point of the study and my personal motivation for conducting this research, the location and context of the study, the significance of the study and finally the entire structure of the whole thesis.

Chapter Two: Critical Thinking and Argument

The aim of the second chapter in this thesis is to present the first part of the literature review related to the study. This chapter explores in-depth the concepts of critical thinking, argument and academic argumentation. Reviewing and discussing the theories and previous works related to critical thinking and argument are divided into eight main sections: the lack of consensus in the field of critical thinking, the reasons of the ongoing lack of consensus, argument and academic argumentation, thinking together, dialectical and dialogic thinking, argument and human to human interaction (HHI) via computer mediated communication

(CMC) and argument and human to computer interaction (HCI) via conversational agents. The final section discusses the main points from this chapter.

Chapter Three: Dialogue Modelling

In the third chapter, the second part of the literature review is presented. This chapter explores the linguistic theories of discourse structure and the computational approaches to dialogue modelling. This chapter starts by exploring human to human interaction theories, and then moving to discover the impact of such theories on creating and designing a sophisticated and advanced natural language processing system such as Botocrates. The chapter consists of six main sections: exchange structure, turn-taking, speech acts, computational approach to dialogue modelling, and the key design principles for conversational agents. The final section of chapter 3 presents a summary of the key issues discussed in this chapter.

Chapter Four: Methodology

The fourth chapter of the thesis aims to describe and introduce the research methodology adopted for carrying out the study. This chapter includes identifying, describing and defending the chosen research design and its methods. The chapter comprises six sections which aim at providing a detailed description of why and how the methodological approach, procedures and instruments were employed for conducting the two stages of the study: modelling and evaluating Botocrates' prototype.

Chapter Five: Stage One: Modelling Botocrates' Prototype

The aim of the fifth chapter is to present the analysis and discussion of the data collected during the first stage of the research. The purpose of addressing and examining the findings in this chapter is not to evaluate the online chat seminars but the focus is maintained on looking at the raw data in a way that could help in building the brain of Botocrates. The analysis and the discussion of the results can enable me to find out 'what should go into the agent's brain'. The interpretations of the results presented in this chapter provide inspiring insights into the development of Botocrates' initial prototype. This chapter consists of two main sections: analysis of the results and discussion of the findings.

Chapter Six: Botocrates' Prototype

The aim of this chapter is to introduce the distinctive characteristics of Botocrates that could promote students' critical thinking and academic argumentation skills through interactions. This chapter can be seen as an extension to chapter five where the analysis and the discussion helped in shaping the development of the early design of Botocrates. Presenting the prototype of Botocrates throughout this chapter contributes to answering the central research question of this stage of the study: what should go into the agent's brain that is likely to promote critical thinking and academic argumentation skills? The sixth chapter comprises five sections: Botocrates' approach, Botocrates' tasks and sub-tasks, Academic Argumentation Machine AAM, and the initial scenarios and dialogue modelling of the expected interactions between Botocrates and users.

Chapter Seven: Stage Two: Evaluating Botocrates' Prototype

The purpose of chapter seven is to present the analysis and discussion of the second stage of the research (the empirical stage). This chapter critically discusses 'what happens when learners interact with Botocrates'. The results from the evaluation stage and their interpretations are intended to measure the success and the failure of the early samples of Botocrates in meeting the final goal of the design. In addition, the discussion of the implications of the findings from this stage are explained in order to justify any further refinements needed to be made to Botocrates' brain. This chapter consists of two main sections: the pilot experiments, and the main evaluation. While the pilot experiments section introduces the findings and the discussion of the first set of the empirical experiments, the main evaluation presents the results and the discussion of the second set of the experiments.

Chapter Eight: Conclusion

The final chapter explains the key scholarly elements that I have developed in my study. The analysis of the main findings and its interpretations are summarized in this chapter in order to present the important outcomes of the study. The chapter includes five main sections: summary of the research, main findings, and implications, major areas of contributions, limitations of the study, recommendations and suggestions for further work, and finally the final words to conclude this thesis.

Chapter Two: Critical thinking and Argument

2.1 Introduction

The aim of this chapter is to explore the concepts of critical thinking (CT), argument and academic argumentation in depth in order to understand how Botocrates can positively and ideally promote students' CT and academic argumentation skills. This chapter is divided into nine main sections. The second section, following the introduction, presents a brief overview of the lack of consensus in the field of CT. The third section explores the reasons lying behind the continued existence of the different stances in terms of how CT and argument should be best defined and taught. This section is further divided into three subsections illustrating the concerns of the disciplines that contribute to defining CT: philosophical, psychological and educational perspectives. The fourth section aims at exploring argument and academic argumentation and the theories underpinning such concepts. As we shall observe throughout the fourth section the terms connected to the goal of this study were articulated carefully and made clear to readers. Because of the importance of the concepts 'thinking together' and 'dialectical and dialogic thinking' connected to fostering students' critical thinking and academic argumentation skills, the fifth and the sixth section explain these terminologies respectively. Since the first stage of the study is designed to explore and analyse students' interactions in online seminars, the seventh section focuses on understanding the nature of argument and Human-Human Interaction (HHI) via Computer Mediated Communication (CMC). The eighth section provides an introduction to the field of conversational agents. The eighth section is intended to cover previous and similar studies related to the use of conversational agents in education, in particular, for engaging users in reasoning and reflective processes. The final section of this chapter provides a brief summary of the main points discussed in this chapter.

2.2 The Lack of consensus in the field of CT

The aim of this section is to explore the field of CT in order to understand the advantages and disadvantages of the contributions made by different disciplines regarding how CT should be defined and taught. Botocrates believes that generating new and novel ideas or arriving at a new understanding requires challenging the existing theories and acknowledging their limitations (Lovitts and Wert, 2009). This section is divided into four sub-sections. The first sub-section is intended to investigate the reasons lying behind the existing lack of consensus in the area of CT. The second, third and final sub-sections clarify the strengths and the weaknesses of the inputs of the three disciplines (philosophy, psychology and education) related to CT.

Although the notion of integrating CT activities in educational practices dates back to the time of the Greek philosopher Socrates (Moore, 2011, Fisher, 2001), reviewing the literature in the field of CT has uncovered a lack of consensus as to how CT should or could be defined (Reed, 1998, Schroeder, 2012, Smitha, 2012). Cuban (1984, p.676), for example, describes the lack of consensus in the field of CT as a 'conceptual swamp' that is problematic to both social scientists and practitioners. Likewise, because there is no single widely accepted definition, Halonen (1995, p.75) describes the area of 'critical thinking' as 'a mystified state'.

> With an increasing emphasis on academic accountability, we need to work toward a better understanding of the varying ways the term critical thinking is used and explore the implications of the variation for effective pedagogy.
>
> (Halonen, 1995, p.75)

There are some authors who criticise the term 'critical thinking' itself and so they use the term 'critico-creative' thinking rather than 'critical thinking' because firstly, the term 'critical thinking' sounds 'negative' (as we would appear to be merely interested in criticising and attacking others' ideas), and secondly, we often have to be very creative and imaginative when considering alternatives and options in order to evaluate arguments and ideas (Fisher, 2001, Passmore, 2010). The questions that arise from this claim are: whether the term CT does indeed sound 'negative', and if so, to whom? The answer would be either it sounds negative to people who are not aware of how to think critically or to those who have been subjected to some sort of erroneous practices of CT. I would argue that we should not rely on the lexical meaning of the word 'critical', but we must encourage the 'ideal practices' of CT. The word 'critical' is defined as "containing or making severe or negative judgments" (LLC, 2014). A critical thinker's judgment is associated with reasoning in order to support the overall argument (Cottrell, 2011, Ruggiero, 2014), and a sound critical thinker is never interested in negatively criticising others' ideas without any grounds or support for her/his claim (Rudinow and Barry, 2007). Furthermore, critical evaluation and judgement involve identifying positive as well as negative sides of arguments (Cottrell, 2011, Lillyman and Merrix, 2012). This is because CT requires consideration of possible outcomes, and therefore consideration of original methods and alternative scenarios (Brookfield, 1991). Indeed, creativity is a very central element to the process of CT (Bailin et al, 1999). In my opinion, the very nature of CT has to be examined and worked upon as opposed to attempting to establish numerous new terms and definitions, otherwise there is a large risk of uncertainty in how to conduct CT, analyse it and properly understand it.

> The pedagogy of thinking contains a dizzying array of terminology. Students are likely to hear about the desirability of various terms that express facets of thinking without necessarily getting the "how to" manual to perform according to teacher expectation within a specific discipline.
>
> (McKeachie and Svinicki, 2013, p.308)

With the various perspectives relating to CT, there consequently arises debate as to how CT should be taught. For example, is it better to be taught directly and explicitly or indirectly and implicitly? Whereas some authors focus on identifying a range of teachable skills of constructing, evaluating and analysing arguments (Judge at el, 2009, Cottrell 2011), others focus on explaining the cognitive process of CT (Cuban, 1984, Sternberg, 1986, Lewis and Smith, 1993). As a result, some educators admit that they face difficulties in understanding the term 'CT' (Fox, 1994, Atkinson, 1997, Moore, 2011), and have a tendency to accept the concept 'on faith' (Atkinson, 1997, p.74). Fisher (2001) claims that teachers have become doubtful of the effectiveness of teaching CT skills indirectly since most learners do not acquire thinking skills through questioning. Teachers have therefore become more interested in teaching CT skills directly through a collection of transferable skills (ibid). However, some scholars have questioned whether, in light of the above, the term 'CT' refers to a range of skills that can be transferred to different situations or whether it is simply a loose term that comprises various formats that are dependent upon their particular context (Moore, 2011). This is a somewhat interesting debate, and will be explored in greater detail throughout this chapter.

2.3 Why is there no consensus in the field of CT?

It has been deduced that there are two main disciplines which have contributed towards defining CT: philosophy and psychology (Lewis and Smith, 1993, Gibson, 1995, Lai, 2011, Schroeder, 2012). Lewis and Smith (1993) argue that the differences between these two disciplines extend beyond using diverse terminologies due to the fact that their definitions of the notion of 'truth' have differing stances and are consequently dissimilar. Since these above two disciplines (philosophy and psychology) work with different orientations and perspectives towards CT, it is not surprising to find a variety of CT definitions that have led to what can be described as a general lack of consensus within the field of CT. In addition to these two disciplines, educational input represented in Bloom's Taxonomy is classified as a sub-discipline that contributes to shaping the concept of CT (Sternberg, 1986, Lai, 2011). The following sections illustrate in more detail the three perspectives regarding CT.

Philosophical perspectives

Philosophical contributions to CT are not new, and date back to ancient times with Socrates' dialogue (Ravenscroft et al, 2007, Ravenscroft et al, 2008, Moore, 2011, Aveyard et al, 2011, Roberts, 2015). Dialogue is defined as "a process of conversation, argumentation and mutual supplementation of ideas between two individuals" (Singh, 2008, P.518). In Socrates' dialogue, the key element to stimulating thinking itself is a certain degree of contradiction, since absolute consensus is "nothing but a dogma" and an "absolute contradiction leads us nowhere" (Singh, 2000, p.262). Socrates' method can be considered as the root of dialectical thinking (Singh, 2000, Paul and Elder, 2006a, Ravenscroft et al, 2008, Chaffee, 2014). A dialectical thinking approach consists of two characteristic features: contradictions and inconsistencies (Peng and Nisbett, 2000). As the dialectical approach is an essential approach to promoting students' critical thinking skills (Warnick and Inch, 1989, Paul and Elder, 2006b, Chaffee, 2014), this shall be explored in more detail in a separate section in this chapter.

Dewey, who was broadly described as the founder of the modern tradition of CT (Jones, 1998, Fisher, 2001), placed emphasis upon reasoning or the grounds which support our conclusions (Fisher, 2001, Matthews and Lally, 2010). Dewey (1910) defines CT as "active persistent and careful consideration of a belief or supposed form of knowledge in the light of the grounds (reasons) which support it and the further conclusion to which it tends" (p.6). Dewey describes CT as 'reflective thinking', as opposed to 'unreflective thinking' in which conclusions are reached without a proper consideration of the matter at hand (Fisher, 2001). It could be said that the philosophical traditions regarding CT place emphasis upon reasoning, and argumentative skills in order to draw valid and sound conclusions (Brown, 1998, Peters, 2008). Resnick (1987) states that, "philosophers promote an approach designed to discipline thinking and guard against the propensities of humans to accept fallacious arguments and draw inappropriate conclusions" (p.30).

From philosophical perspectives, constructing, evaluating and analysing arguments requires some sort of formal rules of logic (Sternberg, 1986, Lewis and Smith, 1993). Paul (1995) points out that philosophical points of view are based on theories of logic, argumentation and reasoning. Consequently, their methods keep the same normative stance of philosophy

(Resnick, 1987). Philosophical perspectives suggest that teaching formal logic enhances our reasoning abilities and especially helps us to discover fallacies in an undisciplined reasoning, which indirectly leads us to better analyse and evaluate arguments (Resnick 1987, Blair, 2009). Informal logic can be seen as a branch of logic emerging from the rejection of employing formal logic for analysing and evaluating real arguments in natural language (Blair, 2009). The majority of informal logic philosophers claim that our ability to reason can be shaped and applied in any domain of knowledge (Resnick, 1987).

The philosophical approach has faced some criticisms because the approach does not always fit in with reality (Sternberg, 1986), and has been described as “a more normative nature than ones based in any actual reality” (Moore, 2011, p.5). It could be possible to describe how human beings think critically in ideal situations by means of a set of rules of logic, but also we need to take into account the shortcomings of people’s abilities of information processing (Sternberg, 1986). Paul (1995) suggests that the philosophical approach towards CT tends to focus only on those whose thinking involves clear persuasion and argumentation processes, with a tendency to analyse arguments but without paying attention to the specific contextual background. McPeck suggests that there is no general reasoning skill, and therefore specific skills might be required in any disciplines (Resnick, 1987, Davies, 2004, Siegel, 2013). It can clearly be noticed that there are two different points of view in respect of how CT should be taught: domain specificity and general skills that can be applied in any domain. In the light of this, my opinion is that CT cannot be oversimplified and depicted merely as general skills. For example, could a surgeon solve mathematical equations by using the same reasoning skills used in the operating theatre?

Without solid empirical research, we cannot follow such philosophical claims, because general skills and subject-specific skills are both essential for teaching and learning CT (Davies, 2004).

> The reason assessment component of critical thinking requires that the student be able to assess reason and their warranting force properly, and that this in turn requires that the student have a good grasp of the principles governing such assessment.
>
> (Siegel, 2013, p.35)

The process of CT is strongly linked to domain knowledge: “it is not a skill, like riding a bicycle, and that, like other skills, once you learn it, you can apply it in any situation” (Willingham, 2007, p.10). Lipman (1988) also raises an interesting point in this respect, arguing that CT relies on judgment, and in turn, judgment should be based on criteria that differ when moving from one domain to another. The domain of knowledge therefore is a key factor in determining what is considered as a "sensible or reasonable application of standards and principles of good thinking" (Bailin et al, 1999, 290). Moreover, research from cognitive science confirms that CT is not a range of skills that may be employed in any context at any time (Willingham, 2007).

Philosophical perspectives regarding CT pay more attention to 'dispositions' or the so-called 'habits of mind' (Moore, 2011). Dispositions can be seen as "the tendencies toward particular patterns of intellectual behaviours" (Costa and Kallick, 2013, p.19). For example, the desire to be well-informed, look for alternatives, be open-minded, take a position, seek reasons and so on (Moore, 2011, Lai, 2011, Ennis, 1985), must all be exercised reflectively (Tishman and Andrade, 1995). Extensive empirical research has been conducted by Facione (1990a, 1990b, and 2000) suggests that effective dispositions seem to distinguish good critical thinkers and bad thinkers. Ennis (1985) argues that our dispositions are detached from our abilities to think critically and, in some instances, certain people have the ability to think critically but are too lazy to do so. The cognitive ability to think critically involves analysing and judging arguments, claims, or evidence, and making inferences using inductive or deductive reasoning (Moore, 2011, Lai, 2011). Thinking disposition in the process of CT is one of the most important areas of agreement between philosophical and psychological perspectives. However, the main difference between them is that psychological perspectives rely on empirical research, whereas philosophical ones base their claims on logical reasoning and the perfection of thought (Lewis and Smith, 1993).

Paul's contributions to CT are noteworthy because he draws our attention to the development of our ability to think when considering our own thinking or what is often called 'metacognition' (Fisher, 2001, Van Blerkom, 2013, Woodrow, 2014). Paul also emphasises that instructional modes should be subjected to criteria and self-assessment (Gibson, 1995). Paul (1990) defines CT as "disciplined, self-directed thinking which exemplifies the perfections of thinking appropriate to a particular mode or domain of thought" (p.50).

> Metacognition: refers to awareness and understanding of one's thinking and cognitive processes; thinking about thinking.
>
> (Paul and Elder, 2013, p.409)

In addition to the cognitive domain, Paul identifies the following standards for what he deems to be 'perfection of thought': "clarity, precision, specificity, accuracy, relevance, consistency, logic, depth, completeness, significance, fairness and adequacy" (Paul and Elder, 2006b, p.21). His model of thinking also includes the elements of thoughts: "purposes, inferences, questions, concepts, points of view, implications, information, and assumption", and the intellectual traits of thinking disposition: "intellectual humility, autonomy, integrity, courage, perseverance, empathy, confidence in reasoning and fair-mindedness" (Paul and Elder, 2006b, p.21). It can be said that the philosophical perspective focuses on fictional critical thinkers or ideal critical thinkers under hypothetical circumstances, whilst listing their characteristics, rather than focusing on their performances in reality (Sternberg, 1986, Lewis and Smith, 1993). Indeed, the philosophical approach is based on the fundamentals of ideal and perfect thinking and on the intellectual behaviours required to be rational (Gibson, 1995). However,

> We need to know the maximum potentials of critical thought, lest we settle for less precision and reflectivity in our thinking than that of which we are capable. At the same time, we need to recognize the personal and situational constraints that often impinge upon our working up to full capacity.
>
> (Sternberg, 1986, p.5)

Psychological perspectives

In contrast to the philosophical perspectives, the psychological points of view in terms of CT give emphasis to problem solving rather than reflective thinking and logic (Lewis and Smith, 1993, Halpern, 2003 and 2007, Sternberg, 2013). From the psychological perspectives, CT includes different types of thinking: reasoning, decision and judgement making, and problem solving (Halpern, 2003, Dorn, 1999, Willingham, 2007, Sternberg et al, 2006). Sternberg et al (2006) define CT as "the use of those cognitive skills or strategies that increase the probability of a desirable outcome…it is used to describe the kind of thinking involved in solving problem and making decisions" (p.6). Thus for Sternberg et al (2006), CT is a type of thinking used in problem solving. Sternberg (1986) states that, CT is "the mental processes, strategies, and representations people use to solve problems, make decisions, and learn new concepts" (p.3). However, when solving problems, it is possible to be both critical or not (Bailin et al, 1999). Great focus should be given to the reasoning process that takes place during problem solving activities. Being involved in problem solving does not necessarily ensure solving that problem using CT skills. Based on theories of cognition, extensive research concludes that people tend to adopt different strategies when engaging in solving problems (Guyote and Sternberg, 1981, Wenke and Frensch, 2003, Sternberg, 2013). Bailin et al (1999) argue that problem solving should be seen as a platform upon which CT may occur, as opposed to a separate sort of thinking to be contrasted with CT. Problem solving skills are essential but not adequate for a comprehensive understanding of CT (Lewis and Smith, 1993). However, Sternberg (1986) suggests that the psychological perspectives sometimes oversimplify the analysis of CT because they constrain research of theories that can be tested, which do not reflect the real and casual circumstances.

Another difference between the philosophical and the psychological traditions outlined by Sternberg (1986) is that the psychological tradition has focused on the nature of CT, particularly “concerned with characterizing CT when performing under the limitations of the person and the environment” (p.3). In particular, these perspectives regarding CT are more concerned with how we think critically when lacking time, background information, or the perfection of our memory (ibid). As the previous section *Philosophical perspectives* illustrates, the philosophical perspectives are more interested in the ideal critical thinker (the goal), but the psychological perspectives aim at examining the process of thinking and how this process could help us to make sense of our experiences using an imposing structure (Lewis and Smith, 1993). Dam and Volman (2004) argue that psychological perspectives conceptualise CT as higher-order thinking skills, and pay more attention to the instruction process. It could therefore be argued that the root of this claim can be attributed to Piaget and his theory of cognitive development. Indeed, based on Piaget and his theory of cognitive development, Woolfolk, (2005) suggests that when people are born, they have a tendency to structure their thought processes in a psychological manner, and this is the foundation for their abilities to understand and interact with the world. Therefore, the cognitive process instruction in psychology aims at improving human thinking by means of understanding the mechanisms that occur in the mind for achieving better thinking outcomes (Halpern, 2014). Furthermore, humans have a tendency to adapt to the environment/context in which they are placed, and two key processes are involved in adaptation: assimilation and accommodation (Woolfolk, 2005).

> Assimilation involves the process of organizing new information into one’s present body of knowledge, and accommodation involves rearranging and restructuring thought the processes to deal with the imbalance caused by new information and thereby increase understanding.
>
> (Nugent and Vitale, 2015, p.120)

In terms of thinking dispositions, psychological perspectives appear to pay more attention to thinking dispositions as metacognition (self-awareness about our own thinking) including self-regulation and self-monitoring (Greenwood et al, 1994, Halpern, 2013 and 2014). While Self-regulation can be described as the capability of people to be self-motivated and self-directed e.g. setting goals and the desire to achieve those goals, self-monitoring is the continuous attention and evaluation of the process of our thinking (Schneider and Lockl, 2002, Tarricone, 2011, Dabbag and Kitsantas, 2013). The psychological perspectives tend to use the terms ‘attitudes’ or ‘habits of mind’, rather than the term ‘thinking dispositions’. The habit of mind can be described as an intrinsic motivation that encourages human beings to adopt intellectual and cognitive skills (Dottin, 2009, Padget, 2012). Bailin (1999) lists some ‘attitudes’ or ‘habits of mind’ related to CT from psychological points of view, such as “respect for legitimate intellectual authority, an intellectual work-ethic, independent-mindedness, respect for others in group investigations, and deliberations” (p.295). Halpern (2013) also identifies different habits of mind required for thinking critically: “willingness to plan, flexibility, and persistence, willingness to self-correct, admit error, and change your mind when the evidence changes, being mindful and consensus seeking” (p.20-24).

In addition, according to the psychological perspectives, the cognitive skills and the subject-domain of knowledge are interrelated. As the process of CT requires particular skills, the domain of knowledge can be describe as “the content of thought” that facilitates applying those skills (Willingham, 2007, p.8). Although the domain of knowledge and thinking skills are interdependent, some general skills of CT exist that transcend particular domains, and are more common and appropriate to other domains (Dam and Volman, 2004). Brown (1997) argues that it is possible for CT to be taught in a specific subject matter, such that it can transfer to other domains. Learners cannot be expected to develop their thinking skills until they are immersed in a domain-specific subject that is relevant to the real world in order that students are stimulated enough to become involved and motivated (Dam and Volman, 2004).

Educational perspectives

Bloom’s Taxonomy of Educational Objectives is considered to be one of the most significant works in education (Paul, 1985, Marzano, 2007, Cash, 2010). In addition to philosophical and psychological disciplines, Sternberg (1986) and Lai (2011) mentioned the educational psychology’s contribution to defining CT when referring to Bloom’s Taxonomy of Educational Objectives. Bloom (1956a) claims that the Taxonomy can be used as “an aid in developing a precise definition and classification of such vaguely defined terms as ‘thinking’ and ‘problem solving’” (p.10). Bloom’s Taxonomy can be utilised as a model of CT or as a framework for developing questions requiring higher level thinking (Moore and Stanley, 2010, Brown, 2004, Hopper, 2011, Oermann and Gaberson, 2013). Brown (2004) states that "while the tenets of CT may be somewhat ambiguous or abstract, Bloom's Taxonomy of Educational Objectives provides a very concrete structure that helps to foster the development of CT skills in classrooms" (p.77).

By 'educational objectives', Bloom refers to clear formulations of the ways in which learners are likely to be changed by the educative process, or "the ways in which they will change in their thinking, their feelings, and their actions" (Bloom, 1956a, p.26). Bloom's Taxonomy identifies the acquisition of learning in three major domains: "cognitive, affective and psychomotor" (Bloom, 1956a, p.7). The cognitive domain contains those objectives related to "the recall or recognition of knowledge and the development of intellectual abilities and skills" (Bloom, 1956a, p.7). The affective domain focuses on the objectives that describe the changes in emotions, attitudes, and values. The psychomotor domain is the "manipulative or motor-skills area" (p.7). As the cognitive domain in Bloom's Taxonomy is more concerned with the development of intellectual abilities and skills, this will be explored in more detail in order to highlight its limitations and constraints.

The cognitive domain contains six major classes:

1. Knowledge at the lowest level,
2. Comprehension,
3. Application,
4. Analysis,
5. Synthesis, and
6. Evaluation at the highest level (Bloom, 1956a, p.18).

The categories of the cognitive domain as explained by Bloom are organised in a hierarchical order and each category requires the skills and abilities which are placed in the lower order (Bloom, 1956a). The lowest level of the taxonomy is knowledge, by which students can remember, either by recalling or recognising ideas and materials. Comprehension levels show the ability of students to grasp the meaning and the purpose of the materials. At the third level of the cognitive domain (application), students can apply what they comprehend in a new situation without being prompted to do so. Analysis levels demonstrate the capacity of students to break down the material into its component parts and detect the connections between these parts and how they are to be organised. Synthesis levels show the capability of students to put together elements and parts in order to form a whole. Evaluation is the highest level of the Taxonomy, in which students are able to make judgements about ideas or material.

Bloom (1956a) states that "our attempt to arrange educational behaviours from simple to complex was based on the idea that a particular simple behaviour may become integrated with other equally simple behaviours to form more complex behaviours" (p.18). For example, problems demanding evaluation are more challenging than problems requiring comprehension. However, moving from simple to complex levels in a linear way has been one of the drawbacks of Bloom's taxonomy. As Marzano (2007, p.9) writes "the hierarchical structure of Bloom's Taxonomy simply did not hold together well from logical or empirical perspectives". Empirical evidence suggests that evaluation should be placed parallel with synthesis, not in higher order (Furst, 1981). Thus, putting the cognitive domain into a linear order from simple to complex has drawbacks because there is a frequent overlap between and within the classes of the cognitive domain (ibid). Because of the way the Taxonomy is proposed, teachers believe that merely asking and answering questions in all of Bloom's categories can stimulate students to think critically (Paul, 1985). Encouraging students to think critically is not a simple matter, however, since it requires more than merely asking questions of each Bloom's categories, and furthermore, the categories themselves "are not independent but interdependent" (Paul, 1985, p.1). Indeed, Bloom (1956a, p.185) himself admits this limitation of the Taxonomy, arguing that evaluation is in the final level of the cognitive domains as it is reliant on other behavioural categories, although this does not mean it is the final stage in the thought or problem-solving processes. Furthermore, it is possible for the evaluation process to precede a person's gaining new knowledge, attempting a comprehension or 'a new analysis and synthesis' (Bloom, 1956a, p.185).

Moreover, some of the terms used in Bloom's Taxonomy are either ambiguous or they are used in wrong ways (Paul, 1985, Ennis, 1985, Anderson et al, 2001, Boostorm, 2005). Paul (1985) argues that Bloom improperly uses the term 'knowledge'. Bloom places 'knowledge' in the lowest level because he confuses it with 'recall' (ibid). Students cannot obtain knowledge before they comprehend, because "getting knowledge is in fact a complex achievement involving thought, and so should be understood as the product of a rational thought process, rather than as recall" (Paul, 1985, p.1). Another example of the blurred terms in Bloom's Taxonomy is 'analysis' (Ennis, 1985, Boostrom, 2005). For instance, the analysis of a chemical compound has different procedures compared with the analysis of an argument, and therefore a teacher may be confused about what they can teach under the category 'analysis' (Ennis, 1985).

Anderson and his colleagues, however, (2001) have attempted to revise and correct the original Taxonomy of Bloom. The new Taxonomy avoids the rigid construction of Bloom's Taxonomy as well as the lack of inclusion of some terms used (Anderson et al, 2001). The new taxonomy consists of:

1. Remembering,
2. Understanding,
3. Applying,
4. Analysis,
5. Evaluation, and
6. Creating (Anderson et al, 2001, p.214).

In terms of CT and problem solving, the new taxonomy takes into account the importance of domain specificity. In addition, problem solving and CT were terms that were commonly used by teachers, whereas 'understanding' could not be popularly used in order to relate to a single category, and so the true meaning of problem solving needs to be deduced from the relevant context in order to be a part of the Taxonomy (Anderson et al, 2001, p.218).

It can be observed that Bloom seems to believe that intellectual abilities and skills are generic skills because he focuses on thinking activities regardless of subject matter (Boostrom, 2005). In contrast, Gardner (1993) confirms the importance of domain specificity, and in his book, '*Frame of Mind*', states that "a normal human being is so constituted as to be sensitive to certain informational content: when a particular form of information is presented, various mechanisms in the nervous system are triggered to carry out specific operations upon it" (p.249). Gardner's theory of multiple intelligences suggests individuals are better to be seen as having a range of relatively independent intelligences: "linguistic, logical-mathematical, spatial, musical, bodily-kinaesthetic, and personal skills including interpersonal, intrapersonal skills" (Gardner, 1993, p.77). In his book '*Multiple Intelligences: New Horizons*', Gardner highlights an eighth form of intelligence: naturalist intelligence (Gardner, 2006, p.18).

More interestingly, Gardner defines 'intelligences' as the ability of an individual to solve problems or to create products (Gardner, 1993). Bloom (1956a) uses the terms 'intellectual abilities and skills' as a synonym to 'CT' and 'problem solving' (p.38). The intellectual abilities and skills can be defined as the aptitude of individuals to discover suitable information and methods in their previous experience and exploit them either to solve new problems or to bring to bear into new situations (Bloom, 1956a). We can notice that the definitions suggested by Gardner and Bloom keep the same notion of psychological perspectives towards CT when giving emphasis to problem solving. However, Gardner prompts us to pay more attention to individual differences (Gardner, 1993). Bloom (1956a) differentiates between ‘intellectual abilities’ and ‘intellectual arts and skills’, arguing that skills refer to manners of operation and general approaches when dealing with problems. On the other hand, the intellectual abilities can be described as the abilities of individuals to use particular technical information to solve a new problem (Bloom, 1956a).

However, Sternberg (1986) argues that even though educational theories have been designed for classrooms, they lack the clarity of their stances regarding CT, which makes it more difficult to evaluate them. These educational perspectives in terms of CT seem to be less specified because it has a combination of the philosophical point of view (what we can do) and the psychological point of view (what we actually do) (ibid). Despite the usefulness and influences of Bloom’s Taxonomy in education in terms of highlighting the difference between lower-level and higher level of thinking (Martin and Briggs, 1986, Moore and Stanley, 2010), Bloom’s Taxonomy has noticeable boundaries when it comes to developing CT activities (Paul, 1985). It is also necessary to go outside Bloom’s Taxonomy in order to consider specific characteristics of CT (Martin and Briggs, 1986). Unfortunately, Bloom’s Taxonomy does not provide enough guidance required by teachers and students to teach and learn CT, because firstly Bloom's ideas in the Taxonomy are vague, and secondly, his Taxonomy is not accompanied by any criteria (Ennis, 1985).

2.4 Argument and Academic argumentation

The aim of this section is to explore theories and practices associated with argument and the process of argumentation. This section covers different issues surrounding argument (the product) and argumentation (the process) including constructing, analysing and evaluating argument.

A typical feedback given to students by tutors or supervisors in academic life when assessing students’ performances are the ‘need to be more critical’ or ‘need to argue rather than assert’. It appears that tutors and lecturers in academic institutions, when giving such comments, evaluate students’ work (the product) according to academic standards and criteria. I would say that, in order to help students improve the quality of their work, we need to pay more attention to the process needed to achieve the desired outcomes. The terms argument, assertion, and argumentation would remain blurred and vague terms to students if they were not previously involved in the process that could promote their academic argumentation skills (Mitchell et al, 2008, Vyncke, 2012, Wingate, 2012). In our social lives, the word ‘argument’ is often used when sometimes referring to ‘disagreement’ and ‘dispute’ (Budgen, 2000, p.9), although an ‘academic argument’ might include disagreement, the disagreement has to be based on reasons (Hollihan and Baaske, 2004, Cottrell, 2011).

The term ‘argument’ refers to the product presented as a consequence of the act of arguing which includes a claim or proposition and the grounds mentioned as evidence to back and support a proposition (Andrews, 2010). According to Walton (2009, p.1), argument consists of three main parts: “a conclusion, a set of premises, and an inference from the premises to the conclusion”. Premises can be defined as stated assumptions or propositions believed to be true, which are used as reasons or as bases for argument (Aleixandre et al, 1999, Barnet and Bedau, 2011). Argumentation is a technical term that refers to the process of producing argument to distinguish it from the product- argument (Kuhn and Udell, 2003, Andrews, 2009). Both argumentation and argumentative discourse can be used to describe the dialogical or the dialectical discourse in which two or more individuals engage in discussion of opposing claims (Kuhn and Udell, 2003). Freeley and Steinberg (2009, p.1) state that “argumentation is reason giving in communicative situations by people whose purpose is the justification of acts, beliefs, attitudes, and values”. On the other hand, assertion refers to any statement that lacks justification or supporting evidence (Cottrell, 2011).

It can be said that the main aim when engaging in argumentation is to convince other people of the rightness of one’s claims by means of logical reasoning and relevant evidence (Hillocks, 2010). The attempt of a critical thinker to persuade an audience when arguing has to rely on setting up reasons in a valid way in order to convince others to accept her/his reasons (Budgen, 2000, Cottrell, 2011, Bowell and Kemp, 2014). However, it must be borne in mind that, persuasion and argumentation are not synonyms. Persuasion can be defined as communication planned to change other people’s acts, beliefs, attitudes or values (Freeley and Steinberg, 2009). For example, advertisements do not always argue their case but they are aimed at persuading people (Andrews, 2009). Any argument should be aimed at rationally persuading others and it must include a conclusion and valid reasons (Budgen, 2000, Luque, 2011). Andrews (2009) suggests that persuasion can be seen as a function of an argument. According to Driver et al (2000), there are two different points of view concerning the relation between argumentation and persuasion. Whereas one side argues that the purpose of argumentation is to seek the rational resolution of specific situations (e.g. question, issue or dispute), the other side sees argumentation as an activity employing the mechanism of persuasion (ibid). Another term which must be distinguished from argumentation is ‘explanation’, which may have the same appearance as an argument due to containing statements, reasons and conclusion, but differs from an explanation because in the latter process, the aim is not persuading audiences (Budgen, 2000, Cottrell, 2011). Walton (2015a) argues that the distinction between argument and explanation relies on the purpose of interactions in which argument or explanation occurs.

Aleixandre et al (1999) define the three forms of arguments: analytical, dialectical and rhetorical arguments (p.163). Whereas the analytical argument is based on the theory of logic such as syllogisms, the dialectical argument involves reasoning and contradiction that can be seen as a part of the informal logic domain. The third form (rhetorical argument) can be characterised as aiming to persuade an audience, employing the mechanism of persuasion. Although there is overlap between the purpose of dialectical and rhetorical argument (both aim to convince audience or readers), the dialectical argument relies mainly on reasons and the rhetorical one “relies also on techniques of persuasion that appeal to emotion, the moral character of the speaker and logic of their effectiveness” (Goddu, 2010, p.55).

Any argumentation can be concluded deductively when the conclusion is drawn with certainty, or inductively as the conclusion is drawn with no more than a degree of probability (Van Eemeren, 1987, Walton, 2006). Therefore, in an inductive argument, audiences might accept our reasoning, but they are still unsure about the drawn conclusion which can be seen when different people end up with a variety of conclusions from the same reasons (Budgen, 2000). Similarly, reasoning in an argument can be divided into two types: inductive reasoning and deductive reasoning (Govier, 1987, Chesla, 2005, Sternberg, 2005). In inductive reasoning, we first start from specific evidence to draw our conclusion (Bensley, 1998, Chesla, 2005). For example, we observe and then draw our final conclusion from that observation. On the other hand, in deductive reasoning we move generally from the conclusion to discover whether evidence is valid or not (Arp and Chesla, 2005, Watson, 2015).

Going back to the debate amongst philosophers illustrated in the section of this chapter *Philosophical perspectives* (when they decided to shift the attention towards informal logic rather than formal logic), a syllogism can be seen as being grounded in formal logic (Clark, 1980). Clark (1980) argues that Aristotle's achievement on syllogism can be seen as the most notable work in formal logic. Syllogism, or ‘a reckoning together’, is a statement presented as a conclusion based on two or more premises (major and minor premises) taken to be true (Barnet and Bedau, 2011, p.82). For example:

Major premise: *All buildings at the University of Leeds are well equipped*

Minor premise: *The School of Education at Hillary Place is a part of the University of Leeds.*
Conclusion: *Hillary Place is well equipped.*

Example 1: Syllogism (conclusion based on two or more premises)

The main criticism for this type of argument (syllogism) is that there is not a new 'truth' or real discovery, and the judgement here is only enumeration (Buckner, 2007). In addition, this type of argument does not reflect the reasoning process that takes place in everyday argument (Harman, 2002). We can notice that testing argument using formal logic is based on mathematical rules (Freeley and Steinberg, 2009). For example, if x = b and b = y then x = y. It could therefore be argued that philosophical traditions since Socrates aim to examine the fallacies of argument by identifying the errors of reasoning so that students would be able to detect these fallacies (Walton, 2009). An example of a formal fallacy is a 'denying the antecedent' fallacy, which is commonly considered as a formal fallacy (Godden and Walton, 2004).

Saudis speak Arabic.
If you cannot speak Arabic then you are not from Saudi Arabia

Example 2: Formal fallacy (denying the antecedent)

Even though it is not obvious that there is a fallacy in this conclusion, and it might be true, nonetheless since a formal argument has to follow a strict rule such as focusing on the form of arguments, we consider this type of argument is invalid (Bennett, 2013), since he cannot speak Arabic, we cannot conclude with certainty that he is not from Saudi Arabia.

On the other hand, informal logic can be described as part of logic merged with the rejection of employing formal logic for the purpose of analysing and evaluating real arguments in natural language (Blair, 2009). It is said that teaching our students informal logic can enhance their reasoning abilities, especially as it helps them discover and detect any fallacy in undisciplined reasoning, which indirectly leads them to better analysis and evaluation of arguments (Resnick, 1987, Blair, 2009). Walton (1984) suggests some of these fallacies e.g. personal attack, appeal to pity, appeal to authority, appeal to emotion, appeal to popular opinions or feelings, begging the question, argument from ignorance and straw man arguments.

Fallacies	Example
Personal attack	A: For the previous reasons I believe that using games in classrooms is problematic. B: I disagree; you said that because you are not confident enough to use them.
Appeal to pity	A: I believe this paper is perfect for publishing in your journal. I really deserve that because my mother was sick while writing it.
Appeal to authority	A: After illustrating these reasons, I would argue that Paul's claim is a weak claim. B: I cannot accept that because Paul is a well-known Philosopher.
Appeal to emotion	A: Sarah has asked me not to go to the CT conference in Spain next month. B: I believe Sarah is right in her advice because she always looks after you.
Appeal to popular opinions or feelings	A: I bought a new iPhone yesterday, even though I was thinking of getting an HTC, but I guess an iPhone is better because more people have iPhones.
Begging the question	A: I believe that Paul is intelligent / B: Why do you think that? A: Because I noticed that. B: What did you notice? / A: Many things.
Argument from ignorance	A: I think there are invisible people around us because there is no evidence to prove they do not exist.
Straw man argument	A: for these reasons, mobile learning can be useful. B: I disagree; students will have access to pornographic images, which is not acceptable.

Table 1: Informal fallacies

Formal and informal logic analytical diagrams regarding arguments are limited to identifying premises and conclusions and, as Weinstein (1990) states: rejecting 'thoroughgoing deductivism' has implications on assessing arguments, because "if the relation between premises and conclusion is not deductive, then some sense must be made of the claim that particular premises offer varying support for the conclusion. This cannot be accomplished through argument diagramming alone, especially if diagrams are limited to identifying premises and conclusions" (Weinstein, 1990, p.124).

Toulmin (1985) suggests an influential model for a better understanding of the structure of any argument (Aleixandre et al, 1999, Johnson, 2012). It can be argued that Toulmin's model shifted the attention for studying arguments from the traditional field of logic towards the natural settings in real arguments (Driver, Newton and Osborne, 2000, Andrews, 2010). Toulmin's model contains six elements: claim, ground, warrant, backing, modal qualification, and conditions of exception or rebuttal (Toulmin, p.94). Andrews, however, (2010) argues that the main function of the Toulmin model is to provide an assessment of the soundness of any argument by firstly testing the relation between claims and evidence, and secondly, testing the relation between the warrant and its backing. *Figure 1* below illustrates the more complex argument in a natural setting where both main argument and counter-argument take place.

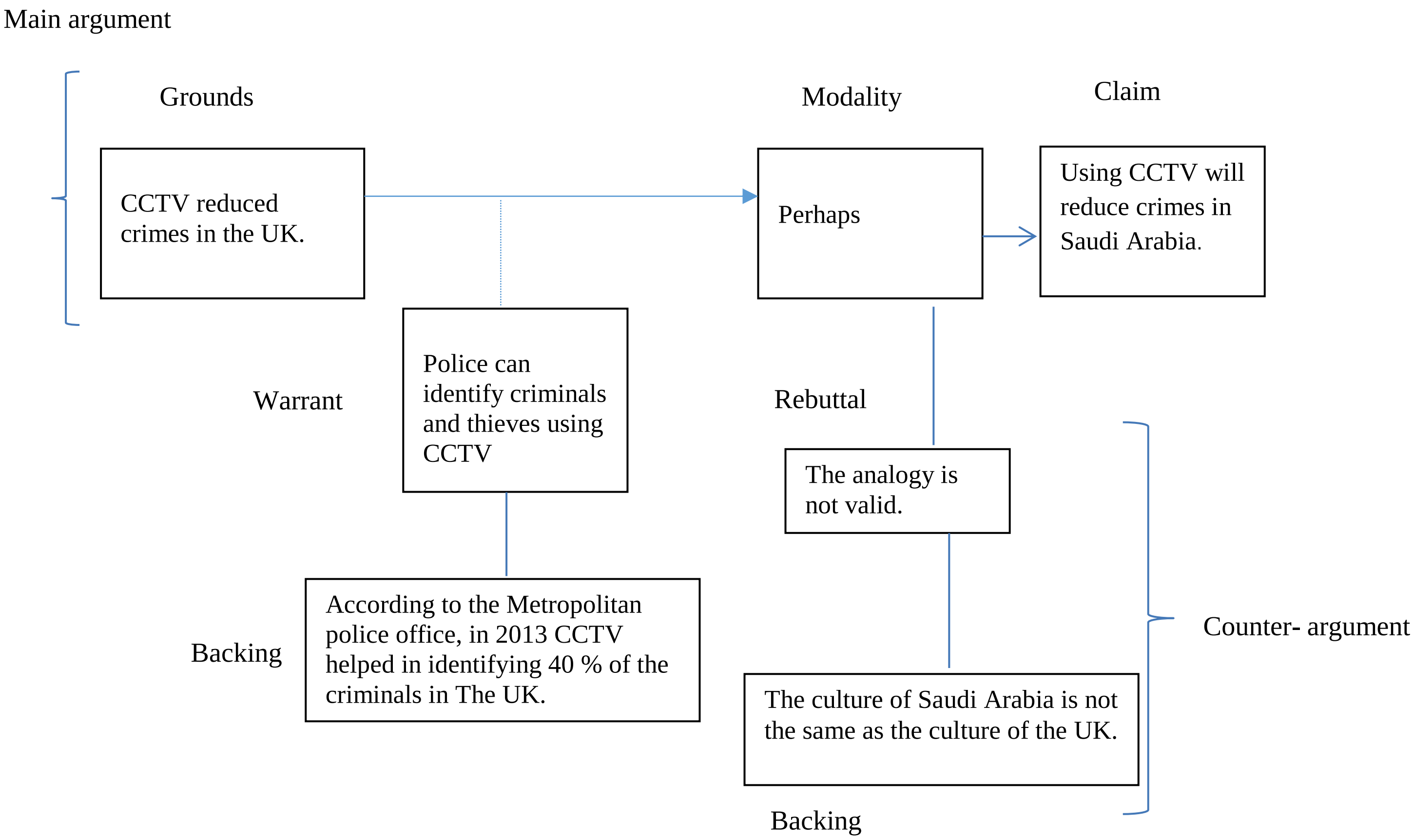


Figure 1: Toulmin's model

(Toulmin, 1985)

The main criticism of Toulmin's model is that firstly it can be applied merely to a single argument because (and this is the second limitation) sometimes it can be difficult to distinguish certain components as Toulmin's categories, for instance, it is difficult to differentiate Backing from Grounds or Modal qualification and Rebuttal. Thirdly, Toulmin's model ignored the role of the audience (Voss and Dyke, 2001). Van Eemeren and Grootendorst (1999) suggest that Toulmin did not pay attention to the dynamic contribution or refutes that could be made by others during natural dialogue conversation. Moreover, as Andrews (2010) argues, applying Toulmin's model to learning scenarios is problematic when stating that,

> Problems with the application of Toulmin's model to learning contexts are not only that the model itself seems not to be dynamic and thus not open to rhetorical variation but that it is technically difficult to understand and apply. For example, the distinction between the warrant and its backing can be hard to maintain. If a 'warrant' is the means by which the evidence counts in support of a claim or proposition, the backing is the set of values or ideological context in which the warrant, proposition, and evidence are validated or given significance (Andrews, 2010, p.45).

As shown in *Figure 2* below, Mitchel and Riddle (2000) suggest another model of an argument which includes the expressions used in real arguments: SINCE, THEN and BECAUSE known as (STB) structure (cited in Goodwyn & Stables, 2004, p.75).

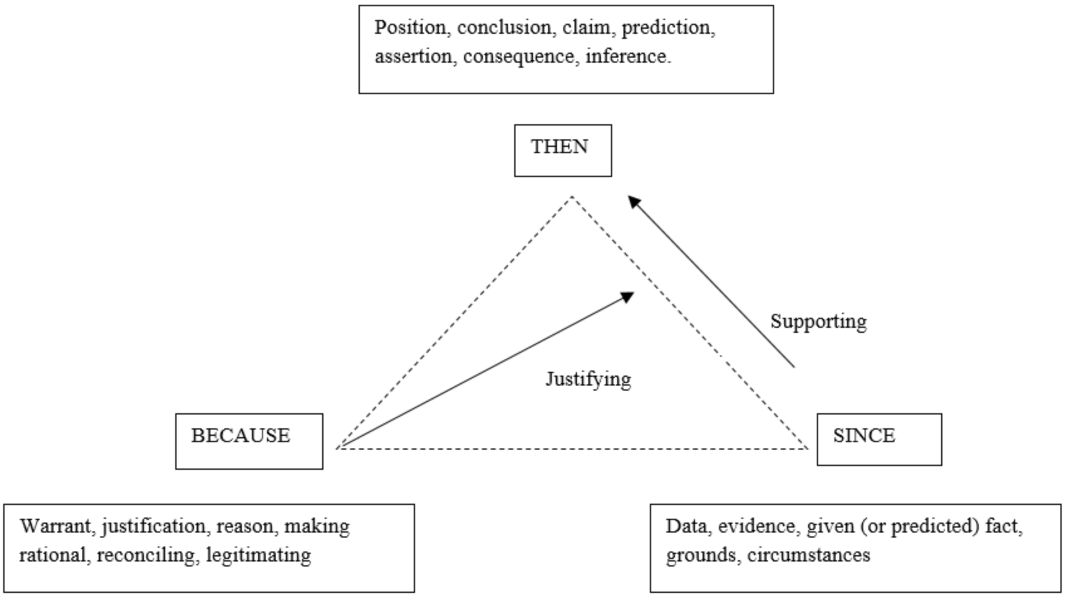


Figure 2: Mitchell and Riddle's triangle model / STB structure

(Goodwyn & Stables, 2004, p.75)

This model is designed to be more flexible and dynamic without following any specific order (Goodwyn and Stables, 2004). For instance, sometimes we present evidence before drawing our conclusions or we might first make a claim which we later then support by evidence (Goodwyn, Stables, 2004). Further, we have to bear in mind that sometimes arguments in real settings or natural language consist of two components: claim and data (THEN and SINCE) or without articulating the justification (BECAUSE). For example, X is a talented person; she works as a software developer for Microsoft. In this sentence, the justification for making the connection between being talented and working for Microsoft as a software developer has not been articulated. Andrews (2010) argues that because Mitchell and Riddle's model is dynamic rather than static, it can help not only as an analytical tool for testing the structure of arguments, but also can be employed as "a generative tool for planning and composing arguments" (p.46). However, it can also be said that when making this model more understandable and applicable, Mitchell and Riddle sacrifice a certain degree of precision because natural language devices are not always used in their model: "The terms used to denote the agents in the act of argumentation– SINCE, THEN, and BECAUSE – are syntactic conjunctions. Their function in conjoining phrases and clauses in sentences is not the same as their function in articulating argumentation" (Andrews, 2010. p.46).

Based on argumentation theories, reasoning may occur in different types of dialogue: "persuasion dialogue, negotiation, deliberation, information-seeking dialogue, inquiry, and eristic dialogue" (Walton, 2010c, p.13). These classifications were made based on the following three elements: the initial situation of dialogue, the goal of participants and the final purpose of the whole dialogue (Walton, 2014).

Type of Dialogue	Initial situation	Participants' goal	Goal of Dialogue
Persuasion	Conflict of opinions	Persuade other party	Resolve or clarify issue
Inquiry	Need to have proof	Find and verify evidence	Prove (disprove) hypothesis
Discovery	Need to find an explanation of facts	Find and defend a suitable hypothesis	Choose best hypothesis for testing
Negotiation	Conflict of interests	Get what you most want	Reasonable Settlement Both can live with
Information-seeking	Need information	Acquire or give information	Exchange information
Deliberation	Dilemma of practical choice	Co-ordinate goals and action	Decide best available course of action
Eristic	Personal conflict	Verbally hit out at opponent	Reveal deeper basis of conflict

Table 2: Types of dialogue

(Walton, 2010c, p.14)

It could be claimed that any academic argumentation should be persuasive in order to convince others (Andrews, 2010, Carroll, 2013). The final goal of the persuasion argument is to remove the conflict between different opinions by rationally persuading them to accept one position over the others (Walton and Krabbe, 1995). Van Eemeren et al (2002) suggest that critical discussion occurs during the persuasive argumentation process and the main goal is to accept or refuse a certain standpoint when different points of views arise. During the process of persuasion dialogue, in order to be convincing, the mechanism of argumentation should be implemented. Let us look at *Figure 3*:

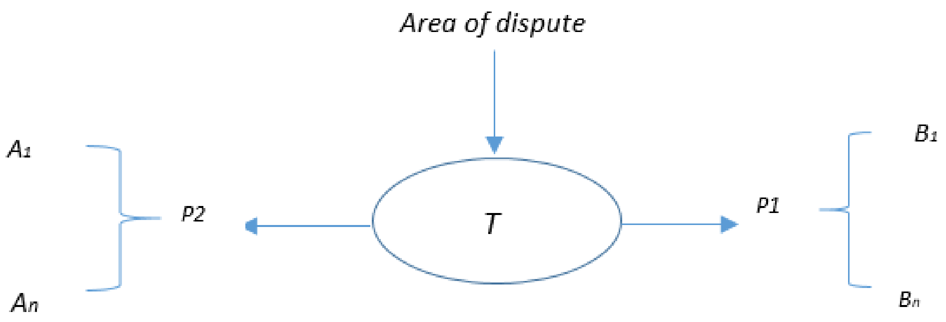


Figure 3: Academic argumentation territory

With the intention of convincing others of the correctness and the validity of the taken position, the proponent or the claimant starts by stating a position (for example *P1*) related to a certain topic *T*, having sufficient support that could convince others (respondents), and defending the taken position against any counter-arguments (Walton, 1998, Waicukauski et al, 2009, Bowell and Kemp, 2014). In academic argumentation the ability of students to produce a valid reason and acknowledge the other perspectives could remove the skepticism of others and eliminate any doubt which could be raised in connection with the taken position (Walton, 2004, Perin, 2010, Weiss and Weiss, 2013).

Andrews (2010) highlights interesting points concerning discipline-specific skills in academic argumentation. Even though there are some generic and transferable skills in argumentation, learners and tutors have a tendency to see some demands of their own discipline as necessary (Andrews, 2010).“Insufficient attention has been paid to argument in each of the disciplines: whereas there are some generic skills that can be used across the board, each discipline will have its own distinctive ways of constructing and validating arguments” (Andrews, 2010, p.2). Therefore, in academic writing, validating and evaluating arguments requires a better understanding of the context or the field of the study (ibid). In addition, Andrews (2010) suggests that, in order to help students promote their academic argumentation skills, the students should be meta-cognitively (thinking about their own thinking) engaged in practices that enable them to gauge and evaluate their perspectives comparing to others' ones. Osborne et al (2001) argues that students have to be aware of the differences between weak and strong arguments so that their abilities of building arguments and evaluating evidence can be developed.

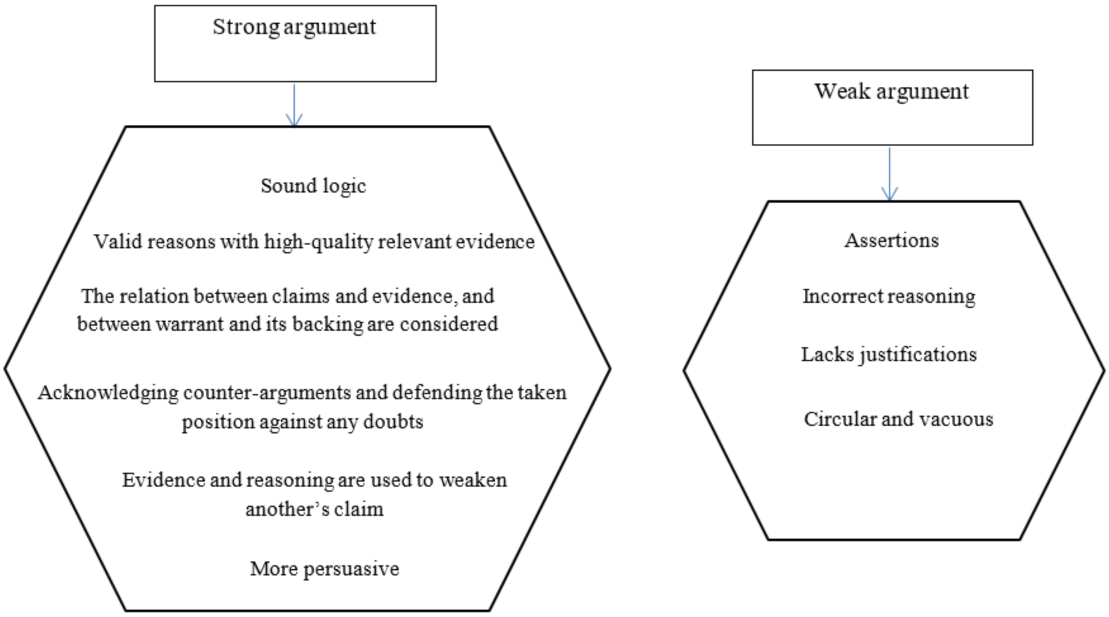


Figure 4: The characteristics of strong and weak arguments

How to judge the quality of an argument?	
Area to emphasize	Helpful questions
Controversy	Is the topic of argument important and worth our attention now? Has the arguer clearly defined the topics and its multiple sides?
Evidence	Are the assertions of the arguer supported by evidence and if so, is the evidence up-to-date? Is there a relation between the conclusions and the evidence?
Premises and Conclusions	Are the premises accurate? Is the reasoning to the drawn conclusion valid?
The opposition	Are the other sides of argument addressed in their true light?
The consequences	Have the consequences of the claims have been seriously considered when put into practice?
Overall consistency	Are the assumptions, reasons, conclusions and purposes of the arguer coherent or are they contradicted?

Table 3: How to judge the quality of argument

(Butler and Christiansen, 1996, P.1, 2&3)

It could be argued that the practice that engages students in such a process could help them to internalize the necessary skills required in academic argumentation (Zohar and Dori, 2011, Tarricone, 2011).

> Metacognitive monitoring is repeatedly cycled as individuals determine if the skills they are using are increasing the likelihood of a desirable outcome or if other skills are needed. When a "good enough" outcome is achieved, the process is stopped.
>
> (Halpern, 2003, p.20)

Students have to recognise what they already know, what needs to be learned and how they can make progress in their own learning (Davies, 2007). Andrews (2010, p.193) stated that "a common complaint about students' work is that it is not critical enough and yet, students are not often showing what that means in their own disciplines or in inter-disciplinary contexts". One way of dealing with this, therefore, is to encourage students to take responsibility for their own thinking and to help them in terms of better expressions and articulations (Andrews, 2010).

2.5 Thinking together

The purpose of this section is to explore one of the approaches that contribute to increasing our understanding of the process of cognitive development that occurs during the dialogue processes. In this section, the different types of interactions that happened during collaborative dialogues will be illustrated. As will be explained, enhancing the quality of communications by focusing on the process of argumentation could lead to obtaining a better product (argument).

As illustrated, the philosophical traditions regarding CT tend to focus on the product rather than the process of CT. As a result, critical thinkers and the process of thinking critically seem to be given the least amount of attention (Thayer-Bacon, 2000). Thayer-Bacon (2000) argues that this can be attributed to the false assumption adopted by the philosophical tradition that claims that knowers can be separated from what is known. Thayer-Bacon argues that knowers cannot be separated from what is known. "We use our personal voices, along with our intuition, imagination, emotional feelings, and reasoning tools, to help us develop enlarged thinking skills" (Thayer-Bacon, 2000, p.12). She suggests that it is necessary to take into account the importance of being engaged in dialogue so people can better understand one another through interactions. Our understanding of the actions and the communicative behaviours of the other parties during the process of dialogue could help in building a shared interest which might promote our cognitive development (ibid).

It can be argued that Thayer-Bacon's perspective regarding CT is inspired by Vygotsky's cognitive development theory. Andrews (2010) states that, "much of the thinking is informed by Vygotsky's theory of the ways in which cultural and historical patterning informs cognitive and conceptual development" (p.14). This ties Vygotsky's notion about the link between our social interactions with our cognitive development, because according to Vygotsky's theory, people employ particular tools, which develop from their own cultures, for example discourse and writing, to mediate their social interactions (Riddle, 1999, Maxwell, 2012, Hopkins, 2013).

> Language functions not only as a mediator of social activity by enabling participants to plan, coordinate and review their actions, but is also the tool that mediates the related mental activities in the internal discourse of inner speech.
>
> (Gibbons, 2006, p.25)

Vygotsky suggests that the internalisation of these communication tools in turn facilitates the development of higher thinking skills (Riddle, 1999, Sehgal, 2005, Hopkins, 2013). Whereas Vygotsky establishes the idea of Zone of Proximal Development (ZPD) that could bridge the gap between what people know and what they can know when interacting with their social environment (Johnston et al, 2011, Dawn et al, 2013), Bruner (1986) reconstructs Vygotsky's ZPD with the metaphor of scaffolding, which elaborates how more-capable learners afford other learners support through graduated, strategic steps that create ZPDs. Bruner (1986, p.73) states that "it is an account of how the more competent assist the young and the less competent to reach that higher ground, ground from which to reflect more abstractly about the nature of things".

Vygotsky's ideas have been developed to suggest that students learn from their peers, not essentially as a result of learning with more capable and competent students, but because they think differently (ProDAIT, 2006). Mercer (2000) suggests that 'inter-thinking' takes place when learners think collectively when performing a joint task, which leads to developing their ideas through dialogue. Littleton and Mercer (2013) argue that the most effective inter-thinking process occurs by means of language used as a medium to manage and accomplish learners' joint tasks. Mercer coined the term 'Inter-mental Development Zone' (IDZ), which can be described as 'a shared communicative space' or the space between our thinking when we communicate with others (2000, p.141). According to Mercer (2008) this area is dynamic and can be evolved continually when the dialogue continues. He claims that we have to effectively maintain the quality of the IDZ so that the misunderstandings between students will be reduced and their motivation will be increased. The results of his research provide some evidence that confirms Vygotsky's hypothesis in terms of the link between social activities (the inter-mental) and individual development (the intra-mental).

Mercer (1995) divides discourses that take place in the classroom into three types: disputational, cumulative and exploratory. Disputational discourse occurs when there is a lot of disagreement between students, and every student has a tendency to make her/his own decisions competitively rather than collaboratively. Cumulative discourse takes place when students accept and agree with their peers' contributions in an uncritical manner, and can be characterised by the lack of careful evaluation and reasonable judgment of their peers' ideas. Finally, exploratory discourse occurs when students are actively engaged in critical and constructive dialogue where the justification of their challenged ideas is articulated. This type of talk can be described as symmetrical where scaffolding and students' cognitive development may occur (Mercer and Littleton, 2007). Mercer (2000) suggests some basic techniques for encouraging students to be engaged in group discussion in classrooms, such as recaps, elicitations, repetitions reformulations, and exhortations (p.52). These type of activities could help students make sense of their experiences and their peers' ones. Based on empirical research, Mercer (2003) points out some ideas to enhance the quality of group discussion such as a) increasing students' awareness of the importance of group discussions and its purposes, b) encouraging students to state their ideas clearly c) making students aware of the need to explain their ideas explicitly along with providing sound justifications for those ideas, and d) aiding students in order to be able to examine their peers' ideas in a critical way.

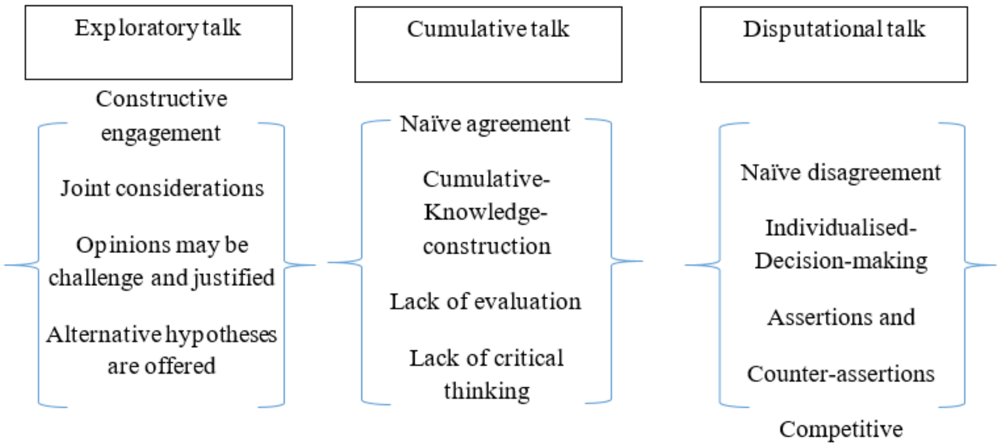


Figure 5: The characteristics of the three different types of talk and thinking (Mercer, 1995, p.104)

Shifting students' discourse into the exploratory category requires a way of learning in which students partake in problem-solving activities whilst being aware of using appropriate language in order to think collectively, and to 'inter-think' effectively (Mercer and Littleton, 2007, Mercer, 2008). Expressing our different thoughts, feelings and opinions requires different types of language function (Hughes and Lavery, 2008). It could be said that increasing the quality of thinking together which could develop our thinking skills requires a better understanding of how we use language that can express our thoughts (Hughes and Lavery, 2008, Long et al, 2010). According to Mercer et al (2005), one of the main concerns that we have to take into account when applying the notion of thinking together is that helping learners to develop their understanding collectively has to be implemented through practicing and developing ways of reasoning based on a better use of language. Consequently, learners need to be engaged in situations where guidance is offered so that their talks can be more constructive and productive (Mercer, 2000, Littleton and Mercer, 2013). The internalization of this process, in turn, could increase the abilities of students to use language as an argumentation 'toolkit' (Mercer, 2009, p.191).

2.6 Dialectical and Dialogical Thinking

The aim of this section is to explain the two approaches that may take place during the argumentation process: dialectical and dialogical thinking. As we will notice, the language used within the mechanisms of both types of process of interactions is dissimilar. Exploring these two approaches, in turn, could enable Botocrates to determine the way of communication that can achieve his ultimate goal of interaction (promoting students' critical thinking and academic argumentation skills).

The philosophical traditions since the time of Socrates pay more attention to the evaluation of argument. One of these ways of judging and assessing an argument is to raise a critical question (Neville, 1981, Walton, 2009). The motive of asking critical questions in a dialectical discussion is the uncertainty about the validity of the proposed claim or conclusion because what is known (belief or knowledge) differs from what is proposed (Thayer-Bacon, 2000, Hook et al, 2002). Therefore, dialectical thinking can be defined as the type of thinking resulting from the contradiction and inconsistency or the dissimilarity between different opinions (Peng and Nisbett, 2000, Cogan, 1998, Hook et al, 2002). Hegel claims that the truth relies on an entire system of propositions, and only within this system can contradictions be recognised and falsity be extracted (cited in Ravenscroft et al, 2008). Peng and Nisbett (2000) state that "the key feature of dialectical thinking is integration, starting with the recognition of contradiction, then moving on to the reconciliation of basic elements of the opposing perspectives" (p.742). Williams (1981, p.600) clarifies the differences between the two terms, stating that "a proposition or belief which is inconsistent is one which is self-contradictory and vice versa. Moreover, two propositions or beliefs which are contradictories are inconsistent with each other". The main difference between dialogue and dialect is that in dialogue "both speakers are related to each other like a subject and the object in proposition", whereas in dialect, "reason is both the subject and the object of the critique" (Singh, 2000, p.263).

According to Ravenscroft et al (2008), the dialectic approach is a way of dialogue emphasising the clarification of meaning and aimed at developing or refining knowledge and understanding by means of 'rational arguments' within 'a reasoned inquiry' (p.23). This definition can be divided into two parts: firstly the clarity of meaning refers to Socrates' method of questioning. The second part is 'rational argument' and 'reasoned inquiry'; in addition to Socratic approaches (see *Figure 6*), this part can be seen in Vygotsky's cognitive development theory of using tools such as speech, words, and writing as mediation in our social interactions. Kuhn (2009a and 2009b) suggests that posing appropriate questions can be seen as an essential skill that plays a crucial role in improving the ability of students to think critically. Chin and Osborne (2010b) claim that when students ask critical questions either to themselves or to their peers, they scaffold their own thinking. The dissimilarity between different perspectives and points of view when engaged in dialectical discussions can be described as a good opportunity for students to construct and refine their own previous knowledge (Ravenscroft, 2011).

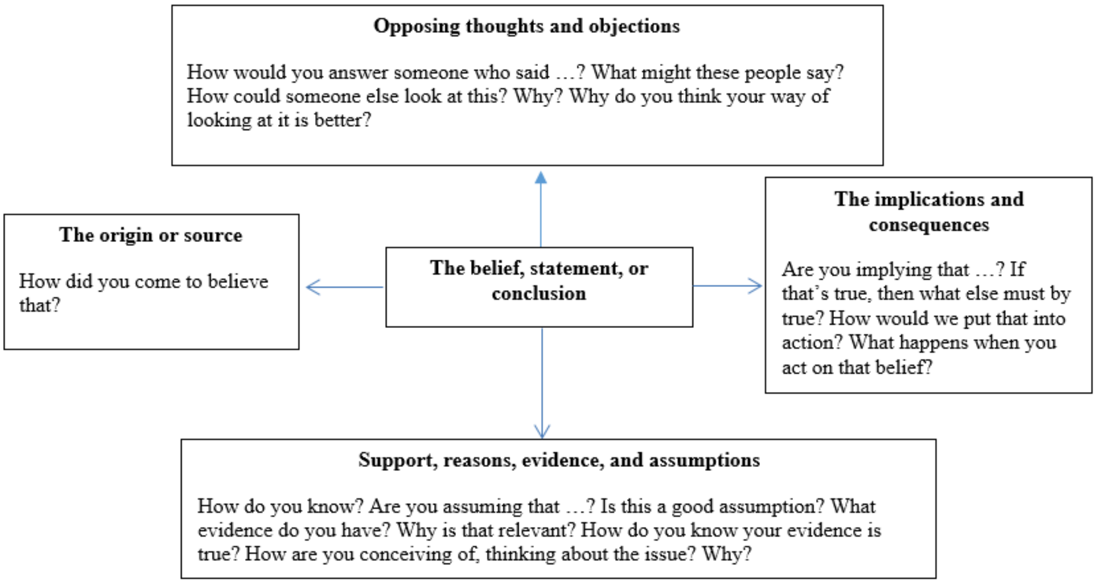


Figure 6: Socratic questioning approach

(Paul and Elder, 2006a, p.13)

On the other hand, the dialogical approach is a way of dialogue, suggesting that our knowledge and understanding evolves in a dynamic way, and can be seen in Bakhtin's notion of using voices as mediation (Wertsch, 1991, Wegerif, 2006), through a process of compromising and making constant improvements by means of descriptions and re-descriptions (Ravenscroft et al, 2008). Wertsch (1991) suggests that dialogical dialogue leads to real and deep understanding. Wegerif (2013) argues that the dialectical approach places an emphasis on contradiction, which does not definitely lead to better understanding but it could lead to recognising someone's or our own ignorance. The dialogic approach in contrast to the dialectical one pays more attention to the perspectives of the other party in the dialogue, which in turn gives the opportunities for the 'dialogic space' to occur (Wegerif, 2007). In addition, establishing dialogic space enables participants in dialogues to see the topic under discussion through the eyes of each other.

> One way in which we can expand our understanding of the space of learning is to acknowledge that the ZPD is not only a kind of physical space in which co-construction occurs but also a dialogue space in which learner and teacher engage with each other and, in a sense, learn to see the task through each other's eyes.
>
> (Wegerif, 2007, p.4).

This notion of dialogic thinking appears to be similar to the notion of thinking together and exploratory talk illustrated in the previous section. Within the dialogic space (compatible with

Vygotsky's idea of Zone of Proximal Development) we can notice overlapping between speakers' stances and perspectives that could encourage sharing and reconstructing knowledge (Wegerif, 2013). In contrast to dialectical thinking which occurs during contradiction and constructive conflict, dialogic conversational moves "focus on empathy and understanding the views of the others" (Ravenscroft et al, 2007, p.53). For example:

Speaker 1: *To solve the problem I suggest X*

Speaker 2: *I disagree with you ... X is not suitable because…*

Dialectical dialogue

Speaker 1: *To solve the problem I suggest X*

Speaker 2: *Another way of solving the problem might be…*

Dialogic dialogue

Example 3: Dialogic and Dialectical dialogues

We can describe dialogic discussion as a more flexible dialogue than the dialectical one as it requires dealing with different orientations (Hala, 2013). Ravenscroft et al (2007 and 2008) explain the relationship between these two types of dialogue (dialectical and dialogic). They argue that the two types are not mutually exclusive and they can be integrated for the purpose of promoting students' argumentative skills. Their argument suggests that the dialectic and dialogic approaches to dialogue can be seen as having different scopes, but they are both very important to learning. It might be said that, establishing dialogic space and giving attention to the others' contributions during dialogue could facilitate the occurrence of dialectical thinking.

> Dialectic emphasises the epistemic and cognitive dimensions of learning that are realised through social processes that occur when an appropriate dialogic state is established.

(Ravenscroft et al, 2008 p.6)

> Although a dialogic approach may well set up the conditions for a wider exploration of ideas leading to a richer dialectical synthesis. So depending on the context, learning could be ostensibly dialogic, dialectic or a blend of both.

(Ravenscroft, Wegerif, and Hartley, 2007 p.54)

Here, I would argue that evaluating academic argument during the argumentation process appears to be more dialectical than dialogic. As illustrated earlier in this chapter (see section *Argument and Academic argumentation*), academic argumentation requires clearly articulating a position, having strong and valid reasons and support, and refuting any counter-arguments. It seems that empathy is excluded from the final stage of being persuasive where the main reliance is on the validity of taken positions. Employing the mechanism of academic argumentation should end up with convincing others rationally of a certain position and overcoming contradiction by dealing with any doubts that could be raised.

> Students need to develop dialectical reasoning skills, so that their thinking moves comfortably between divergent points of view or lines of thought, assessing the relative strength and weakness of the evidence or reasoning presented.
>
> (Paul, 1991, p.318)

As Ravenscroft et al (2007) suggest, adopting the dialogic approach depends on the context and its requirements. The dialogic approach seems to be the central and an essential approach for children and group working where we need to give more attention to the feelings of participants (Wegerif, 2006 and 2013).

2.7Argument and HHI via CMC

The aim of this section is to explore the nature of argument and argumentation via CMC. This section is significant to the research study because the first stage of the study aims at examining and exploring students' interactions in online seminars. There are different topics covered in this section, for example, exploring written interactions and their implications on the dialogue process, the theoretical foundations that support argumentation via CMC, and other important issues surrounding the use of CMC to undertake critical interactions.

HHI via CMC can be divided into two main forms of communication: synchronous interactions where the communication happens at the same time (e.g. online seminars), and asynchronous interactions (e.g. discussion boards) where interactions occur at different or delayed times (Thurlow et al, 2004, Wright and Webb 2011). There are some differences between these two types of interactions in terms of what can be brought to the discussion such as the degree of flexibility, efficiency and depth (Nichols, 2009). However, because of the rapid development in technology, this classification might be, to some extent, unclear since we are able to engage in very close real time communication using email or any kind of communication labelled as asynchronous interactions (Bodomo, 2010). There are different studies in the field of Information Communications Technology (ICT), which focus on distinguishing between the nature of CMC (for example, see Romiszowski and Mason 1996), particularly whether the interaction is textual (text-based discourse), and multimodal (audio/video-based discourse) interaction (Zahner et al, 2000, Hampel and Hauck 2004, Bodomo 2010, Mirza 2010). It could be said that there is no a clear cut distinction between these features and much of the differentiation is based on things like communicative situations and the goal of interaction (Greiffenstern, 2010).

Empirical studies and theories suggest that CMC can be used to promote arguments and CT skills (Garrison et al, 2000, Ravenscroft 2000, Ravenscroft and Pilkington, 2000, Ravenscroft, 2003, Ravenscroft and McAlister, 2006a, Pilkington and Walker, 2003a, Walker, 2004). Andrews (2010) argues that the majority of high level discourses (arguments) that occur via CMC are text-based dialogues. However, text-based discourses lack visual and aural paralinguistic cues such as facial expression, tone of voice and other physical gestures (Garrison et al, 2000, Park and Bonk, 2007a). As a result of lacking the physical cues in text-based chats participants are required to state clearly and explicitly their contributions (York et al, 2008). The linguistic content is very significant in text-based chats (Lemus et al, 2004). Synchronous text-based chat enables participants to practice the use of language by means of "interactive communication and meaningful interpretation" (Jia, 2014, p.35).

Another advantage of using text-based chats connected to promoting CT skills is that shy students who fear or are reluctant to participate in traditional classrooms feel more motivated and comfortable to participate in online discussions (Vonderwell 2003, Johnston et al, 2005, Serlin 2005). Stress is seen as harmful to learning, in particular limiting students' abilities to think critically because students are less likely to raise questions or to receive and make judgment (Tanner and Amato, 2012). In addition, recent research confirms that participating in online discussion increases students' autonomy (Abraham and Williams, 2011, Wash, 2012), and boosts students' motivation and interest (Warschauer, 1996a, Kadir and Din, 2006). According to Deci and Ryan (1987), "autonomy support has generally been associated with more intrinsic motivation, greater interest, less pressure and tension, more creativity, more cognitive flexibility, better conceptual learning, a more positive emotional tone, higher self-esteem, more trust and greater persistence of behavior change" (p.1024). Garrison et al (2000) claim that a written dialogue in asynchronous communications is considered better than oral dialogues, when the goal is higher-order thinking because it provides time for participants' reflection. I would argue that even synchronous text-based chats can help in this respect as students' conversations can be recorded (Andrews, 2010), which helps students to revisit the chat scripts and reflect on their participation.

However, we have to bear in mind that not all online discussions are simply successful (Wilson and Allen, 2011, Kelsey and Amant, 2012); some students concluded that face-to-face interaction is better than online discussion (Wang, 2004). Waschull (2001) and Wilson and Allen (2011) found that students in online classes were less successful than their counterparts in face-to-face classes. Park and Bonk (2007b) state that "positive student experiences and satisfaction in synchronous discussion could not be achieved without planned instructional support and the appropriate use of communication tools employed by the course instructors" (p.314). Therefore, effective design of e-learning activities in online environments is the key to achieving better engagement and outcomes (Brosche, 2010)

> E-educator will need technology training and effective course design in the online environment training. This course design training must include a thorough understanding of related theories, various e-learning styles and effective teaching strategies and tools for the online learning environment.
>
> (Skinner, 2010, p.465)

E-instructors have to take into account establishing a community of inquiry that promotes students' abilities to think critically (Garrison et al, 2000). The model of community of inquiry suggested by Garrison et al (2000) constitutes three essential elements: cognitive presence, social presence and teaching presence.

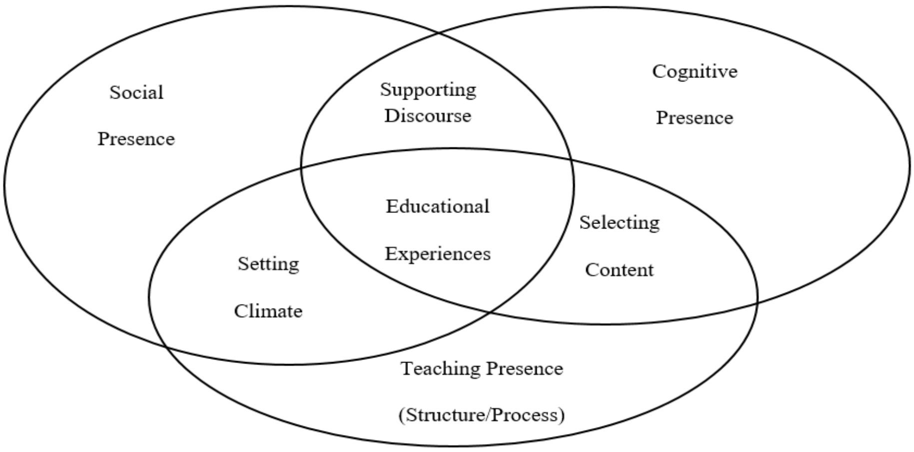


Figure 7: The Community of Inquiry model that supports CT

(Garrison et al, 2000, p.88)

It can be argued that this model is supported by a cognitive constructivism perspective (rooted in Piaget's theory), and a social constructivism perspective (based on Vygotsky's theory). "Whereas cognitive constructivists focus on making learning more relevant, building on student prior knowledge, posing contradictions, and addressing misconceptions, social constructivists emphasize human dialogue, interaction, negotiation, and collaboration" (Bonk and Cunningham, 2006, p.34 and 35). As *Figure 7* shows, the model consists of three main parts. First, cognitive presence is considered as one of the vital elements of the process of CT. This part indicates the abilities of students to construct meaning and knowledge through sustained interaction within the community. Secondly, social presence is defined as "the ability of participants in the Community of Inquiry to project their personal characteristics into the community, thereby presenting themselves to the other participants as real people" (Garrison et al, 2000, p.89). The Community of Inquiry model emphasises social presence as a very important element that indirectly facilitates the process of CT. As studies of social interactions reveal, there is a strong relationship between our cognitive development and our social interactions (Gauvain, 2001, Rubin et al, 2009). These interactions are mediated by tools such as speech, writing and words. As claimed by Vygotsky (1978), the internalisation of these tools leads to a high level of thinking skills. Park and Bonk (2007b) argue that e-moderators have to pay more attention to building a social environment and group cohesion "under time-pressed conditions" in order to increase learning effectiveness (p.253). Finally, teaching presence refers to the design and facilitation of educational experiences.

> The community of inquiry wants to build a system of thought. It begins with provisional scaffolding made up of the relevant beliefs that are already held, the aims of the project, and the values that are to be upheld. The procedure is dialectical: Specific judgments are moulded to accepted generalizations, and generalizations are moulded to specific judgments.
>
> (Lipman, 2003, p.103)

Salmon (2000) suggests a model of teaching and learning online. Salmon's model consists of five stages: access and motivation, online socialization, information exchange, knowledge construction and development (Salmon, 2000, p.29). Salmon's model of teaching and learning online is based on social constructivism (Salmon, 2007). At the first stage, access and motivation, students and e-moderators are able to access the online environment easily and show their motivation when spending time and effort. The second stage, online socialization, shows that students get used to the new community of practice by building relationships with their peers and instructors. In the third stage, information exchange, students become active participants and appreciate the easy access to a broad range of information. The fourth stage, knowledge construction, shows students' engagement in active learning by writing their ideas and appreciating others' perspectives. She claims that starting from this stage, e-moderators can develop activities for promoting CT such as "judging, evaluating, comparing and contrasting and assessing" (Salmon 2002, p.29). In the final stage, development, students become meta-cognitively engaged in their learning by taking responsibility for their own learning. Although Salmon's model significantly emerged from asynchronous text-based discussion (Salmon, 2007), she also addressed the role of e-moderators in synchronous interaction (Salmon, 2000). Apart from the popularity of Salmon's model (Moule, 2007, Watts 2010), the recent findings show that understanding this model needs more guidance in terms of how to judge the readiness of students to move from one stage to another (Moule, 2007).

In terms of argument and CT, unfortunately Salmon's model does not provide any criteria or guidance required by either e-moderators or learners for constructing, analysing and evaluating arguments. Guidance and criteria are essential elements for enhancing students' thinking skills (Paul, 1985, Ennis, 1985). In addition, Salmon (2002), in her book *E-tivities*, mistakenly did not differentiate between argument and dispute when she wrote that, "It is important that the e-moderator avoids the temptation to discount experience expressed (or allow other participants to do so) in any way or to counter it and enter into argument" (p.31). It could be said that, Salmon fails to distinguish between argument and argumentation, as well as using a 'lay' (and simplistic) definition of 'argument'. We can understand the first part of her sentence (not discount others' experiences), yet when students become involved with argumentation about their experiences, they practice CT which helps them to make sense of their experiences (Lewis and Smith, 1993, Mercer, 2003). However, it might be argued that Salmon was not invoking the academic understanding of the term 'argument' but rather in the everyday social meaning of 'dispute'. I would say that if we could describe argument as a tree, then dispute or disagreement can be seen as the seeds of this tree. Andrews (2010) claims that identifying the area of dispute is an essential step toward the generation of argument. Therefore, we have to enhance the culture of academic argumentation so that we can ensure a better environment for the growth of these seeds. 'Argument' might include disagreement, yet any disagreement in argument has to be based on certain reasons (Cottrell, 2011). Refuting counter-argument with supportive reasons is an important skill for academic and career success (Carroll, 2013).

Furthermore, thinking dispositions include “intellectual humility, empathy and fair-mindedness” (Paul, 2006, p.21).

I acknowledge that Salmon (2000) based her work on constructivism theory that encourages students “to explore their own thinking and knowledge building process’’ (Salmon, 2002, p.48). Salmon (2000) appears not to acknowledge the role of instructors (e-moderators) in terms of enhancing students’ argumentation skills and dispositions, which can be seen as an essential factor for promoting CT skills (Osborne et al, 2001, Andrews, 2010). “We need to focus on how to develop thinking and reasoning in learners, support the social skills and presence to apply these cognitive skills and cultivate active participation in improving learning communities or communities of practice” (Ravenscroft, 2003, p.13).

It could be argued that the conversation through synchronous online chat can easily become messy and anarchic (Yoon, 2006, Laurillard, 2013). Therefore, online facilitators should empower participants to play some roles in order to develop a sense of ownership and responsibility (Bolcher, 2008, Laurillard, 2013). Pilkington and Walker (2003a) note that the facilitation of argumentation in online chats is more challenging than face-to-face interactions which require tutors to actively encourage participants to adopt different roles. Pilkington and Walker (2003a), propose three different types of roles: (a) community building roles, (b) management roles, and (c) argumentation roles (p.44). While the community building roles aim at developing trust and increasing participation by receiving or sending acknowledgments and feedback, the goals of management roles are to ensure that all the discussion topics are addressed within a limited time frame and to encourage participants to focus on the topics being discussed. The third class of roles aims at developing argumentation skills which include: challenging others’ ideas, asking for clarification and explanations, and finally building content roles such as providing information during the discussion spontaneously or when replying to others’ questions. We have to bear in mind that the supportive scaffolding process requires the tutor to guide and model the ideal roles, and then fade from the discussion so that the internalisation of such roles can be achieved (Jackson et al, 1998).

Based on formal dialogue game techniques proposed by Mackenzie (1979) and Walton (1984), who defined some structural rules and commitments for dialogue games, Ravenscroft and others have designed different educational dialogue games, such as AcademicTalk, CoLLeGE and Interloc, for promoting collaborative argumentation and effective interaction (Ravenscroft, 2000, Ravenscroft and Pilkington, 2000, Ravenscroft and McAlister, 2006a). “Dialogue games are an innovative and, admittedly, experimental interaction form meant to support, structure and guide conversations for modelling" (Hoppenbrouwers et al, 2013, p.41). Different research suggests the usefulness and effectiveness of these dialogue games (Ravenscroft, 2000, Ravenscroft and Matheson, 2002, McAlister et al, 2004, Ravenscroft and McAlister, 2006b). One of the works presented by Ravenscroft is a socio-cognitive game called 'InterLoc' (Ravenscroft and McAlister, 2006a, Ravenscroft and McAlister, 2006b). InterLoc is based on different learning theories and studies that emphasize the importance of dialogue as a central element to learning, such as those proposed by Vygotsky (1978), Mercer (1995), Ravenscroft (2001) and Wegerif (2007). Based on Vygotsky's theory, Ravenscroft (2001) states that

> It is through the communicative process that external sign systems conveying interpersonal communication become internalised to operate as intrapersonal psychological tools that can transform mental functioning. In other words, internal language and thought are transformed from the 'outside'.
>
> (Ravenscroft, 2001, p.141)

When using InterLoc, students have to follow the rules of the game which require them to select and choose from locution openers to make their contribution and then complete it in their own words. Each opener has semi-structured sentences depending on their different purposes (for example, inform, question, challenge, reason, agree, and maintain). I would argue that as InterLoc uses a dialectical and dialogic approach (Ravenscroft et al, 2008), it can be described as a useful tool that could enable students to raise critical questions. One of the ways of judging and evaluating claims and arguments is to pose a critical question (Walton, 2009). Such questions could provide students with a good opportunity to establish argumentation and promote students' critical thinking skills (Kuhn2009a and 2009b). During the argumentation process where the challenge of ideas is presented, learners could scaffold their own thinking and their peers' thinking as well. However, will students be able to select the right choice from locution openers? In other words, do students have the ability to structure a solid argument? How can we enhance students' abilities to evaluate the soundness of their argument using InterLoc? It would be useful if InterLoc could achieve this aspect of promoting academic argumentation skills. Academic argumentation skills include understanding and evaluating the strength of argument (Driver, Newton and Osborne, 2000, Freeley and Steinberg, 2009), including testing the soundness of argument (the relationship between a claim and its line of reasoning) (Andrews, 2010).

2.8 Argument and HCI via Conversational agents

This section comprises three subsections devoted to providing readers with some relevant literature related to conversational agents and the specific applications designed for pedagogical purposes, in particular, engaging users in the argumentation process. The first subsection presents a brief overview of the field and the history of conversational agents and chatbots. The second subsection is intended to explore the potential advantages of using conversational agents for educational purposes. The third subsection explains various applications of conversational technologies proposed for the purpose of engaging users in reflection and argumentation processes.

Conversational agents

Human to Computer Interaction (HCI) refers to any interaction which occurs between humans and computers (Surie et al, 2012). The field of HCI aims to investigate the design, implementation, and the usability of computer systems (Kumar, 2005). The interaction between humans and computers could be described as “a highly restricted interface” (Marin and Nieto, 2011, p. xiv). Natural Language (NL) aims to overcome such limitation and enable users to communicate with computers using natural language interactions rather than being restricted to the use of keyboard and mouse (Zadronzy et al, 2000, Tan and Nijholt, 2010). NL enables users to type their questions or statements and to interact with computers using their own words (Kim, 2007). Emulating human dialogue by computer requires understanding, analysing and generating natural language, which can be obtained by a subfield of Artificial Intelligence (AI) called Natural Language Processing (NLP) (Dale, 2003, Kim, 2010). NLP, which also could be referred to as computational linguistics, is the scientific approach to the study of language from computational angles (Kumar, 2011). AI is a branch of computer science concerned with investigating how to create machines that show and perform intelligent behaviours (Krar and Gill, 2003, Rudas and Fodor, 2008). Different disciplines, such as psychology and philosophy, attempt to contribute to the field of AI in order to explain and model the functioning of the human mind (Akerkar, 2014).

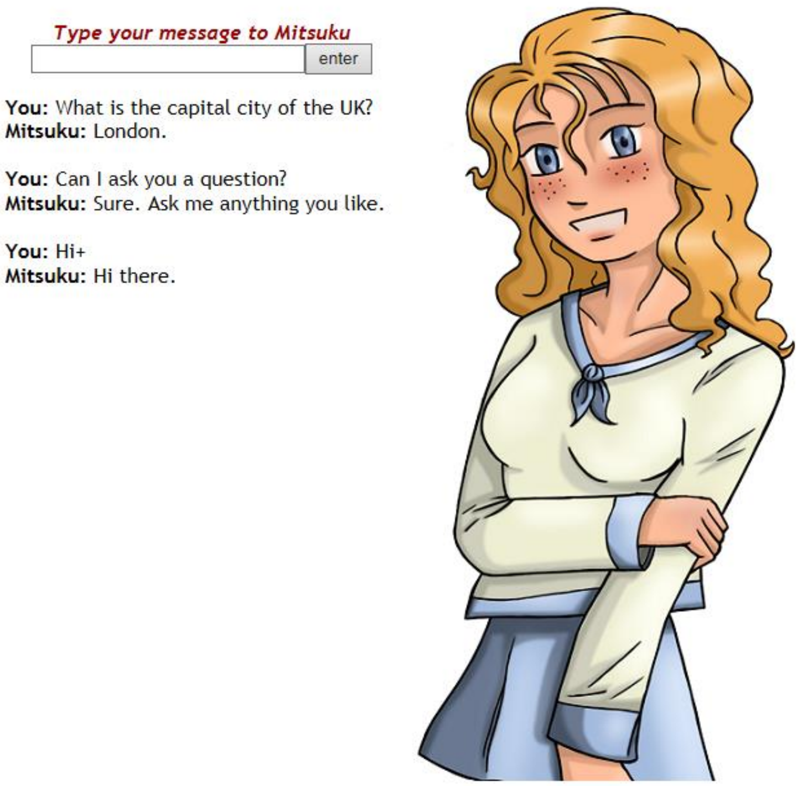
Conversational agents are computer programs that take advantage of NLP to help users in interacting with computers and to be engaged in dialogues using natural language interaction (Abu Shawar and Atwell, 2007a, Marin and Nieto, 2011). Conversational agents can be created in several characters such as animated (e.g. gestures and facial expressions), text-based, and voice-based interfaces or they can combine different modalities (Marin and Nieto, 2011, McTear et al, 2016). A Conversational agent that has a virtual animated character and a visual appearance (part or the whole body) is called an embedded conversational agent (Cassell, 2000). Chatterbot or chatbot refers to a type of conversational agent that is created to communicate with users using a textual or an auditory mode of interaction (Imran and Kowalski, 2014). Conversational agents and chatbots can be classified into two categories a) task-oriented agent, the agent is required to accomplish a task or a set of tasks, and b) non-task-oriented agent, the agent is only created to be engaged in a simple and general conversation (Kane, 2016).

The history of chatbots dates back to the time of the chatbot called ELIZA (Weizenbaum, 1966). The responses of ELIZA try to mimic a psychotherapist to encourage users to express their feelings and emotions or discuss any topics that the users are interested in. For example, the responses of ELIZA to users' inputs can be '*tell me more',* '*come, come, elucidate your thoughts'* or similar sentences. Weizenbaum (1966) claims that the aim was to provide an opportunity for users to be heard, but at the same time such a technique does not require ELIZA to have stored information about the topic being discussed.

> This mode of conversation was chosen because the psychiatric interview is one of the few examples of categorized dyadic natural language communication in which one of the participating pair is free to assume the pose of knowing almost nothing of the real world.
>
> (Weizenbaum, 1966, p.42)

To answer and respond to users, the ELIZA chatbot was programed to recognize keywords and select the most appropriate response that matches a user's input (Heller, 2005, Abu Shawar and Atwell 2007a), by using two main techniques: keyword spotting and pattern matching (Marin and Nieto, 2011). Various chatbots were produced based on ELIZA's syntactic approach to language processing (Kerly and Bull, 2006, Jia and Chen, 2008). For example, Wallace (1995), who was inspired by ELIZA, programed a chatbot called ALICE (Wallace et al, 2003). The ALICE bot was awarded the Loebner Prize three times (2000, 2001 and 2004). Wallace programed ALICE using Artificial Intelligence Mark-up Language (AIML) (see Alicebot.org). The success of such a chatterbot in finding the correct and most suitable response relies mainly on the extensive effort made to program a set of patterns which could match a user's input (McTear and Raman, 2004).

Although human to computer conversation appears to be a comparatively developing area, chatbots have been utilized for different purposes and show usefulness in different domains such as e-learning, information retrieval, ticket booking, customer support, and for entertainment (Abu Shawar and Atwell, 2007a, Zakos and Capper, 2008, Marin and Nieto, 2011, O'shea et al, 2011, Tegos et al, 2014). Nowadays, plenty of chatbots have been released for performing different tasks (see chatbot.org). *Example 4* shows one of the chatbots that was created to be engaged with users using a textual method of interaction.



Example 4: Chatbot (Mitsuku)

Mitsuku was created in 2003 to entertain and amuse users. The more users interact with Mitsuku, the cleverer the chatbot becomes (see Mitsuku.com). In other words, frequent and repeated interactions with users help the designer to identify the shortcomings and the limitations of the design, which in turn leads to the development of the system. The success of such systems in dealing with users' inputs depends on knowledge stored and programmed in their files (Abu Shawar and Atwell, 2004). Most of the produced chatbots (including Mitsuku) are edited manually. By recording and revising the transcripts of the chats which happen between the chatbot and users, the chatbot's files can be modified and updated to overcome any shortcomings occurring during the interactions (Brunelle and Denecke, 2011). Steve Worswick, Mitsuku's botmaster (the one who programs and controls what the robot says), used rules written in Artificial Intelligence Mark-up language (AIML) for designing Mitsuku (Higashinak et al, 2014). Mitsuku was awarded the Loebner Prize (2013), which is given to the most human-seeming conversational agent. After four rounds of conversing with judges, Mitsuku was announced in 2013 as the most humanlike chatbot (see www.loebner.net).

It can be argued that one of the main advantages of AIML is the ease in which it encourages anyone who has previous experience with HTML to start utilizing a chatterbot. According to Wallace (2003, p.36),

> The simplicity of AIML makes it easy for non-programmers, especially those who already know HTML, to get started writing chat robots… One ambitious goal for AIML is that, if a number of people create their own robots, each with a unique area of expertise.

Indeed, the ease of AIML and ALICE being an 'open source' encouraged over 500 botmasters from around the world to contribute to ALICE's knowledge base, and as a result, ALICE contains more than 41,000 pattern-template pairs and categories of knowledge (see Alicebot.org).

However, such techniques used in the early chatbots such as ELIZA and ALICE are seen as the simplest dialogue systems which are vastly limited and cannot accomplish complex interactions for achieving advanced tasks (Jurafsky and Martin, 2009). The next sections illustrate some of the shortcomings of the simple pattern-matching techniques which justify the need for a more sophisticated dialogue system to perform tasks such as the one Botocrates aims to achieve.

Conversational agents for educational purposes

Several studies attempt to explore and investigate the use of conversational agents and chatbots for educational purposes (Knill et al, 2004, Kerfoot et al, 2006, Kerly and Bull, 2006, Kerly et al, 2006, Fryer and Carpenter, 2006, Abu Shawar and Atwell, 2007c, Kerly et al, 2009, Jia, 2004, Jia and Chen, 2008, Jia, 2014, Tegos et al, 2014). Fryer and Carpenter (2006) conducted an empirical study to examine the potential role of chatbots in education. In the study, 211 students were asked to chat with two different chatbots (Jabberwacky & ALICE) and the feedback obtained from a brief survey was analysed. The findings demonstrate that the majority of students (85%) felt more comfortable when chatting with chatterbots than with their peers or tutors and they described talking to chatbots as entertaining and amusing. Fryer and Carpenter (2006) argue that one of the benefits of using chatbots for practicing language is their readiness to chat with users endlessly. Another advantage is that the conversational agent offers convenience, since learners can access the agent through the internet anytime from anywhere (Lehtinen, 2008). Different studies suggest that pedagogical conversational agents can also serve as a scaffolding device (Lehtinen, 2008, Chaudhuri et al, 2009, Stahl et al, 2010). Conversational agents are believed to be useful tools for coaching and motivation in the learning process (Haake and Gulz, 2009).

Knill et al (2004) examined the use of the chatbot for solving simple mathematical template problems written in natural language. Knill et al (2004) suggest that apart from being entertaining, chatterbots can help in enhancing the quality of mathematics learning and the teaching experience and make a noteworthy contribution to learning. Knill et al (2004) argue that the log extracted from the interaction between the agent and learners is valuable as it could be a serious source of reflection and data mining.

> By accessing logs, we can see how people learn, what questions are asked. The logs can provide information how useful the tool will be for students. It helps to improve the database.
>
> (Knill et al, 2004, p.4)

Stahl et al (2010) also report the effectiveness of the conversational agent in scaffolding the students' ability in mathematical work. Kerfoot et al (2006) investigated the advantages of utilizing a chatbot in medical education. The system was designed to encounter users with different clinical scenarios and to give feedback to users' correct and incorrect answers. Kerfoot et al (2006) confirm that such a system could effectively enhance users' acquisition of medical knowledge. Using the Wizard of Oz experiments (WOZ), a human being plays the role of the system (my study used WOZ during the evaluation stage), Kerly and Bull (2006) and Kerly et al (2006) explored the use of chatbots for negotiated learner modelling. Based on users' answers (multiple-choice and short answers) to different questions posed by the wizard, the wizard tried to infer users' beliefs in order to allow users to be engaged in negotiations about their own understandings. The experiments suggest that chatbots could be used for facilitating users' revision of their beliefs and understandings. Tegos et al (2014) investigated the use of a conversational agent for scaffolding group discussion. The agent was designed to provide supportive intervention during group discussion. During the interaction the agent dynamically detected the topic and displayed the intervention in a pop-up frame. The study revealed that users found the intervention provided by the agent was valuable because it led them to acquire better understanding of the subject domain.

Another area where such tools can be employed for pedagogical purpose is language learning and teaching. Seneff (2006) explored different advantages of the use of chatbots in the process of foreign language acquisition. Seneff (2006) argues that interacting with users anytime from anywhere using either spoken conversational agents or text-based agents has positive impacts on language learning. Similar findings were reported by Fryer and Carpenter (2006). While most conversational agents are created to chat with users about pre-designed topics, based on a corpus-training approach, Abu Shawar and Atwell (2007c) were able to retrain a chatbot to discuss with users about domain specific topics. The findings from their study demonstrated that an adaptive chatbot could be utilized for enhancing language learner autonomy and provide students with the opportunity needed to be engaged in active and independent learning. The feedback obtained from the students showed a good level of satisfaction as they described the chatbot as a useful and enjoyable tool. De Gasperis and Florio (2012) examined the impact of conversing with chatbots on second language learning. De Gasperis and Florio (2012) concluded that when students interact using a text-based agent, they are engaged in learning by the typing process. Learning by the typing process in turn helps students to recognize their misspelled words and properly reconstruct their sentences (ibid). Walker and White (2013) suggest various advantages in the use of chatbots in language learning and teaching e.g. when interacting with the chatbots students will be able to construct their sentences at their own pace, and be able to repeat and listen (as many times as they want) to the models of pronunciation presented by the agents. A chatbot can be seen as a virtual partner that could enable users to practice the target language (Jia, 2014).

However, not all users' experiences when interacting with conversational agents or chatbots are completely successful. The evaluation of the chatbots from users' perspectives in different studies reported some negative and unsuccessful experiences. For example, when the conversation gets complex, the chatbots' responses can be inadequate, expected, redundant, and lead to circular conversation (Chantarotwong, 2005, Jia and Chen, 2008). Some students described some of the chatbot responses as rigid (Kerly and Bull, 2006). In the study conducted by Abu Shawar and Atwell (2007c), users found some of the chatbot's responses did not make sense and were unrelated. As suggested by Abu Shawar and Atwell (2007c), the cause lying behind such feedback is that the pattern data needs to sufficiently cover the context of the conversation. The chatbot can only respond to the user's input if the input matches a pattern in its knowledge base (Augello et al, 2013). In addition, if the mechanism for detecting patterns and the templates were not clearly designed, incoherent responses may occur (Abu Shawar and Atwell, 2007c). Such a problem seems common in most chatbots that are based on a set of pattern-template pairs where the reliance is on a huge pattern data (Kluwer, 2011a). It could be said that, in order to overcome such limitations, and to make more coherent and flexible interactions possible, there is a huge emphasis on the study of the dialogue, including applying Natural Language Processing (NLP) (Marin and Nieto, 2011). NLP helps in making the conversation more coherent (Bandyopadhyay, 2012), because coherent conversation requires the meaning and the intentions of users and the conversational systems to be "understandable linguistically" (Bainbridge, 2004, p.484).

Argument and conversational agents

Various applications of conversational agents and chatbots were produced for the purpose of engaging users in reasoning, reflective thinking and argumentation processes. The study of employing conversational technologies for such a complex task aims at extending the use of these tools beyond a simple interaction such as entertainment or information retrieval (Andrews and Quarteroni, 2011). Exploring the field of conversational agents revealed that different approaches have been adopted for enhancing users' engagement in argumentation and reflection processes e.g. the use of one conversational agent to scaffold group discussions (Walker et al, 2011, Huse and Le, 2016, Le and Huse, 2016), the use of two agents (called trialogue) to interact with one user (Cai et al, 2014, Grasser, 2015), and the use of one conversational agent to interact with one user in one-to-one interaction (Grigoriadou et al, 2003, Kerly et al, 2008).The focus here is maintained on the works produced to engage one user in one-to-one interaction (between a human and a conversational agent) which are compatible with the nature of this research study.

With the intention of engaging users in a reflection process, Grigoriadou et al (2003) proposed a simple conversational agent designed to promote users' reasoning abilities. Before interacting with the system, users are required to read a text connected to a historical issue. Using a sequential text-based representation of different questions related to the topic under discussion, the system tries to diagnose users' answers (e.g. positions, justification) and infer their cognitive profiles (by evaluating the outcomes: 'arguments'). *Figure 8* shows an example of the questions and the alternative answers given to users during the interaction with the system.

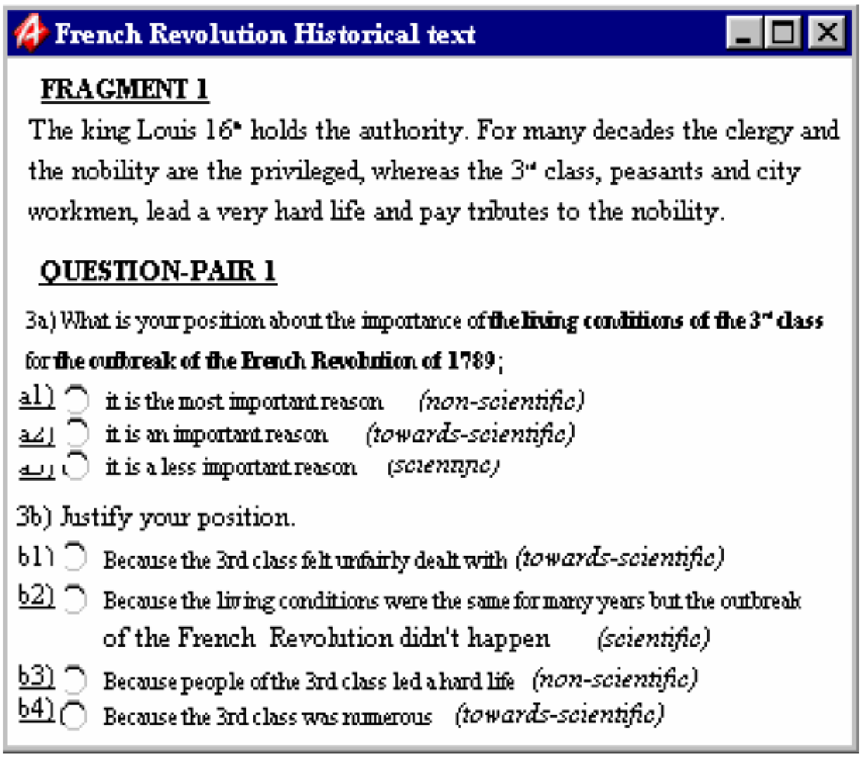


Figure 8: Grigoriadou et al's system (2003)

Based on the dialogue-parts' library and the dialogue plan, after answering the questions, the system confronts users with the shortcoming or the strength of their arguments (position + justification). Users can also ask the system to offer further explanation of the analysis of their arguments. As we can notice such a system could help users to reflect on their own strategies and understanding which might enable them to be engaged in the critical thinking process (Matthews and Lally, 2010). In their study Grigoriadou et al (2003) found that such processes enabled users to be aware of their reasoning which in turn helped them to construct more coherent arguments.

Similar to the Grigoriadou et al (2003) approach, Kerly et al (2008) proposed a system called *CALMsystem*. *CALMsystem* was developed based on previous research which used the Wizard of Oz experiments (Kerly and Bull, 2006, Kerly et al, 2006). The system was designed to foster reflection and self-assessment. In order to infer users' beliefs, during the interactions with *CALMsystem*, users were asked different questions about different topics. In addition to the evaluation made by the system, users were also asked to evaluate their own understanding. By storing users' beliefs in the knowledge base, the system was able to engage with users in negotiations about their own understandings. As *Figure 9* shows, the system offers users the opportunities to view their own evaluation of their understanding and abilities or to compare their own beliefs with the beliefs held by the system.

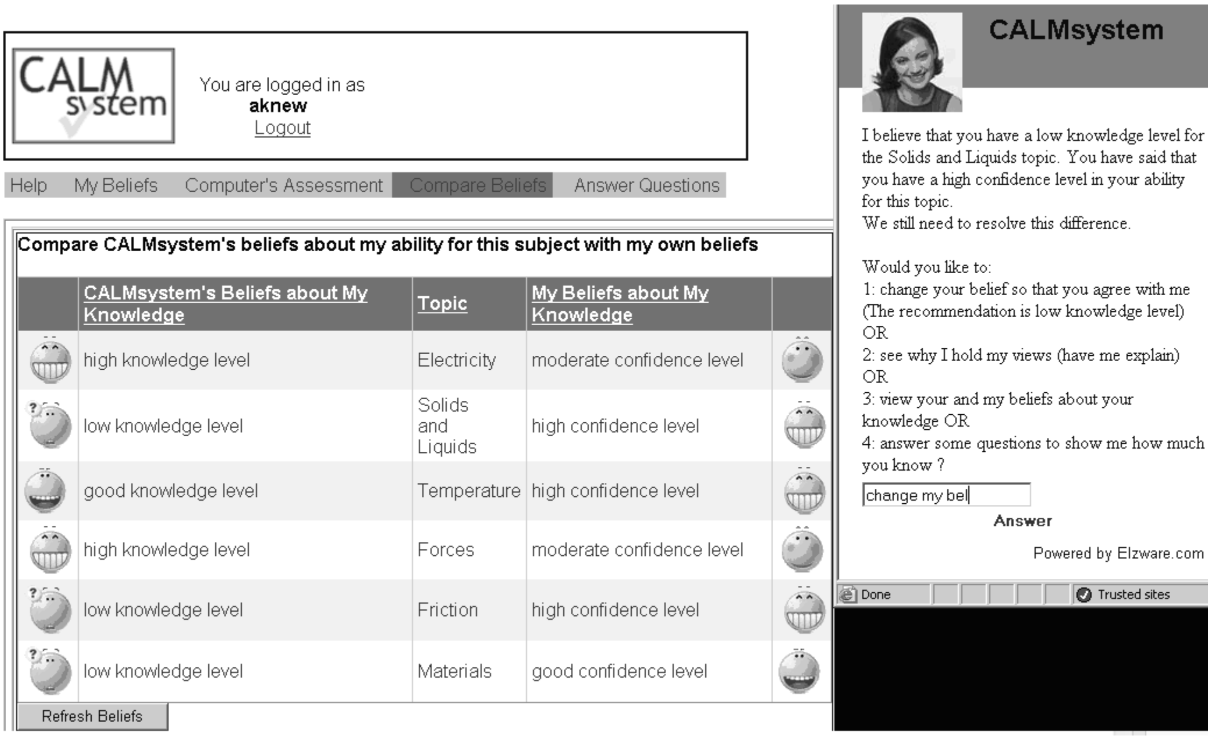


Figure 9: The CALMsystem user interface (Kerly et al, 2008)

CALMsystem used different variables to infer users' beliefs such as "current user activity, current conversational status or current learner model status" (Kerly et al, 2008, p.8). The results from the study showed that the *CALMsystem* chatbot encouraged users to develop their metacognitive and self-assessment skills. However, such ways of interactions proposed in Grigoriadou et al (2003) and Kerly et al (2008) are too far from being described as a human-like conversation. As we can notice, both systems employed very restrictive interfaces, which guided users and limited their options during the interactions (Antony and Santhanam, 2008). It could be said that the use of such restrictive interfaces aims at avoiding any unexpected utterances that users may produce (Kluwer, 2011a). We need to engage users in a more natural conversation. The design of pedagogical agents needs to be less restrictive and to act like a human does in natural interaction (Van Straalen et al, 2009). The designers of pedagogical conversational agents should take into account the 'personalization principle' which emphasises the need to create a more human-seeming conversation (Clark and Mayer, 2011).

> This approach resembles human-to-human conversation. Of course, learners know that the character is not really in a conversation with them, but they may be more likely to act as if the character is a conversational partner.
>
> (Clark and Mayer, 2011, p.160).

One of the limitations of simple pattern matching techniques used in traditional chatbots is the deficiency of the system when there is a need to control and accomplish a complex task such as the argumentation process (Jurafsky and Martin, 2009). The scope of interaction in most of the simple pattern matching systems covers only a single adjacency pair e.g. greet/greet, question/answer (Andrews and Quarteroni, 2011). Almost all traditional chatbots do not include a real understanding of user's utterances (Jokinen, 2010). The argumentation process may include more than a single adjacency pair (e.g. question-answer) (Scheuer et al, 2012). During the argumentation process, the agent needs to lead the interaction through different stages (Gilbert et al, 2003). Therefore, both local coherence (adjacency pair) and global coherence (the sequence of turns) are essential (Jokinen, 2010). The complexity of the task requires a sophisticated dialogue management approach (Jokinen and McTear, 2010). The nature of the argumentation process involves dialogue modelling and dynamic detection of the users' intentions presented in their utterances (Andrews and Quarteroni, 2011).

Different computational studies have produced several conversational agents for engaging users in persuasive dialogue via natural language interaction (Mazzotta et al, 2007, Smith et al, 2008, Cavazza et al, 2010, Narita and Kitamura, 2010, Andrews and Quarteroni, 2011). Persuasive conversational agents can be seen as task-oriented agents which aim at persuading users to change their behaviours or attitudes (Narita and Kitamura, 2010). Creating a conversational agent that aims to persuade users requires the agent to adopt certain dialogue strategies. For example, the agent presented by Mazzotta et al (2007) was based on previous theories of persuasive dialogues, e.g. Walton (1992). In addition to persuasive dialogues theories, Mazzotta et al (2007) highlighted the importance of the corpora that reflect the goal of interactions. For designing the agent that could change users' eating behaviours, Mazzotta et al (2007) collected two corpora. The first corpus included 32 messages gathered from different subjects to provide the study with the content and the potential scenarios of the dialogue such as the positive and negative consequences of vegetable rich/poor diets. The second corpus was collected using the WOZ experiments (30 text-based and 30 speech-based dialogues) to test users' interactional behaviours when interacting with the system. Mazzotta et al (2007) suggested that the WOZ experiment is valuable as it could improve the design with various users' conversational behaviours. Similar to Mazzotta et al (2007), Smith et al (2008) designed a conversational agent for encouraging users to adopt a healthier lifestyle. Smith et al (2008) argued that modelling the activities is seen as an essential part of designing the system.

Using the WOZ experiments, Narita and Kitamura (2010) developed a conversational agent that aimed at changing users' attitudes on e-shopping sites. The agent was designed to assist a user to choose one camera over a large number of items. Their study was carried out using two stages of the WOZ experiments (the first stage employed 60 participants and the second one employed 11 participants). Narita and Kitamura (2010) claimed that creating a conversational agent for performing a complex task such as persuasion requires a dialogue model that informs how the agent can respond to a particular input produced by a user. During the interaction with the user, the system should be able to change the sequence of its conversational moves according to the response presented by the user. The agent needs both conversational rules and purposeful moves to achieve the final goal (Narita and Kitamura, 2010). Based on the results from the study, Narita and Kitamura (2010, p.19) described the use of persuasive conversational agents as 'promising'. Cavazza et al (2010) designed a conversational agent that intended to influence users' emotional attitudes regarding their relations at work. For creating the agent Cavazza et al (2010) employed some persuasive strategies and techniques. As they suggest, the success in achieving the goal of interaction (changing attitudes in persuasive dialogues) relies on designing better effective strategies which in turn need to consider different communicative behaviours.

Andrews and Quarteroni (2011) developed a conversational agent for engaging a user in a simple persuasive argumentation process. The study suggests that planning an argument is vital for achieving the persuasive goals. Planning the argument includes predicting the dialogue path and what the agent should present during the interaction. The purpose of planning the argument is to enable the agent to follow the dialogue structure and select the best outputs tailored to the argumentation process. For evaluating the system, the Desert Survival Scenario was presented to the users. During the Desert Survival Scenario, the user (who is stranded in the middle of the desert after an airplane crash) is asked to rank the most important items that he should keep. After choosing the items, the system tried to change the user's initial ranking. *Example 5* below extracted from the study conducted by Andrews and Quarteroni (2011):

The system: *don't you agree that we should stay close to the plane wreckage? So the rescue can find us.*

User: *I guess you are right.*

The system: *I think the flashlight could be useful as it could help us at night, let's rank it higher.*

User: *How is that? We are not going to move during the night.*

The system: *Well, if we want to collect water, it will be best to do things at night and not under the burning sun.*

User: *I see. It could be useful then.*

Example 5: Desert Survival Scenario

(Andrews and Quarteroni, 2011, p.194)

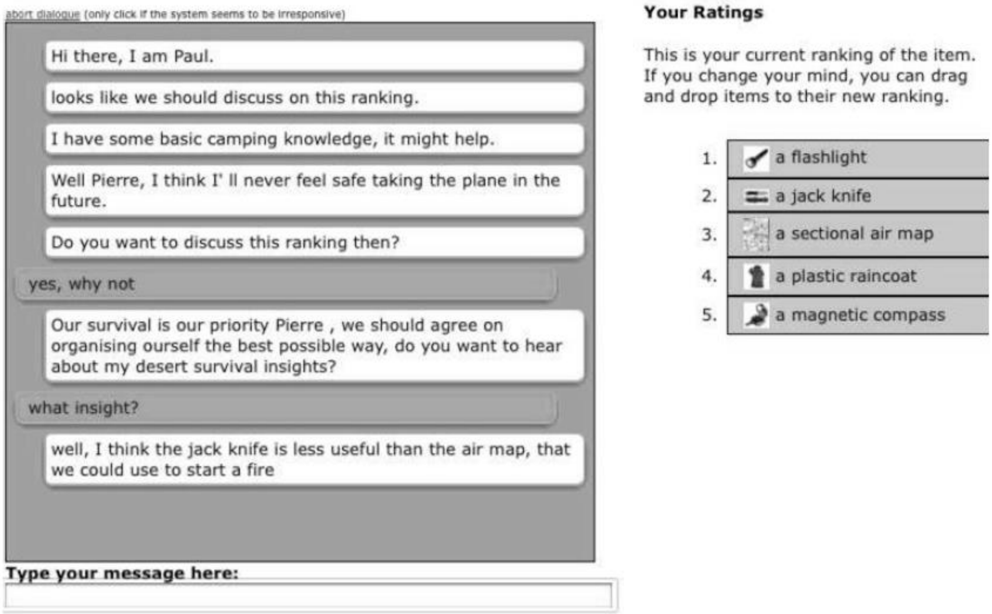


Figure 10: The PD system interface (Andrews and Quarteroni, 2011)

Andrews and Quarteroni (2011) suggest that 'avoiding coercion' and 'not alienating' the users during the interaction could achieve both better engagement and better persuasiveness, especially if the system was designed for long term use (p.199).

2.9 Conclusion

This chapter is intended to explore different concepts and theories related to CT and academic argumentation. CT and argument are the key concepts discussed in this chapter. Both concepts emphasise the need to give consideration to the process of reasoning and better thinking skills in order to reach the desired outcomes. For promoting CT and argumentation skills different understandings were explained. It can be said that the main and common aim of these efforts made by various disciplines is to encourage reaching a better conclusion. The conclusion made by someone is seen as the outcome of her/his own thinking process. Therefore, there is a need to focus on the process and the mechanisms of thinking for fostering students' skills. Such skills are not a ready-made package that can be delivered immediately. Improving students' thinking skills requires students' engagement in a process that could enable them to develop their cognitive abilities. Through interaction students can bridge the gap between what they actually know and what they can know. Enabling students to be engaged in the argumentation process in turn could help them to be aware of the process that could lead them to a better outcome.

In order to promote students' CT and academic argumentation skills, Botocrates should enable users to internalise the elements of the argumentation structure. By being familiar with the elements of argumentation, a user might become more convincing when producing the product 'argument'. Users should take into account different opinions and they should also rationally discuss the strengths of one position over the other opinions. The first step for such a process requires Botocrates to encourage users to state their own positions about a certain topic and consider any counter-arguments connected to the topic under discussion. For creating such constructive conflict, Botocrates has be familiar with the territory of the discipline. Botocrates has to assist users to consider any flaw in their arguments. The final process of the interaction with Botocrates should help users to pay more attention to fulfilling the commitments of stating a particular assertion. Confronting users with any hidden issues or dissimilar opinions may lead users to re-evaluate their own initial positions. The process of gauging the strengths and the weaknesses of their own arguments in turn might enable users to be meta-cognitively engaged.

Most traditional chatbots were not created to achieve complex tasks. The success in completing and achieving a particular task requires dialogue systems designed and tailored to accomplish the final goal. For designing a conversational agent that aims to engage users in the argumentation process such as Botocrates, the system has to properly be able to deal with different interactional behaviours that could be adopted by users. Botocrates needs to be designed to deal with more than isolated and single adjacency pairs. Both the local coherence and the sequence of turns must lead to a successful completion of the task. Addressing different communicative situations during the interaction requires both dialogue modelling and conversational contents. While dialogue strategies inform the system how to act according to users' input, the dialogue content is essential for implementing the conversational moves that can fulfil the goal of interaction. Various studies have emphasised the need for contexts that reflect the goals of the designs. Employing the WOZ experiments enables the designer to both generate corpora that are representative of the specific tasks and evaluate the initial design of the systems.

The next chapter explores dialogue modelling and the key design principles for creating conversational agents for achieving a specific task.

Chapter Three: Dialogue Modelling

3.1 Introduction

This chapter explores theories and practices related to dialogue modelling. Exploring interactive language used in natural conversational settings provides important insights into how the process of interaction between Botocrates and users can be coordinated and managed (Carroll, 2000a, Kobsa et al, 2012). Human to human conversation and language theories are essential for modelling dialogue for conversational agents (Perez-Marin, 2011, Stent and Bangalore, 2014). At the early stage of the design process, the developers of conversational systems need to define the tasks and the dialogue strategies that could successfully achieve the final goals of interactions (Mazzotta et al, 2007, Lee et al, 2015).

This chapter consists of seven main sections. The first three sections, following this section, aim at exploring the nature of HHI in natural settings. These sections include sub-sections, which illustrate the impacts of the communication mode (synchronous text-based chats) on the nature and the mechanisms of the dialogue. The fifth section explains computational approaches to dialogue modelling: a) grammar-based approach b) plan-based approach c) collaborative or joint action approach. The sixth section, key design principles for creating conversational agents, aims at exploring the three-stage process required for creating a conversational system. The sixth section is divided into three sub-sections: early focus on tasks and users, building a simulation and prototype, and iterative design. Each sub-section provides readers with a detailed description of the objectives and goals of each stage of designing a conversational agent. Finally, the main points discussed in this chapter are summarized and presented in the final section.

3.2 Exchange structure

The interaction between Botocrates and users involves exchange of knowledge or information. The aim of this section is to explore the structural function of each utterance within the process of information exchange during HHI. Effective design of the dialogue process needs a better understanding of the structure of information exchange (Beun et al, 1995, Sheratt et al, 2010). The overall framework of a particular exchange structure should contribute to achieving the final goal of communicative interaction (Jackson and Jacobs, 1992, Burns and Coffin, 2013).

The study of Exchange structures of dialogues is mostly influenced by the original work of Sinclair and Coulthard (1975), which can be described as a significant and effective approach to Discourse Analysis (DA) (Brazil, 1995, O'keeffe et al, 2007, Walsh, 2011). Sinclair and Coulthard (1975) suggest a model for the description of interactions that take place in traditional classrooms. According to Sinclair and Coulthard (1975) the descriptive system is a hierarchical one that consists of five rank scales: Lesson is at the highest level, Transaction, Exchange, Move and at the lowest level is Act.

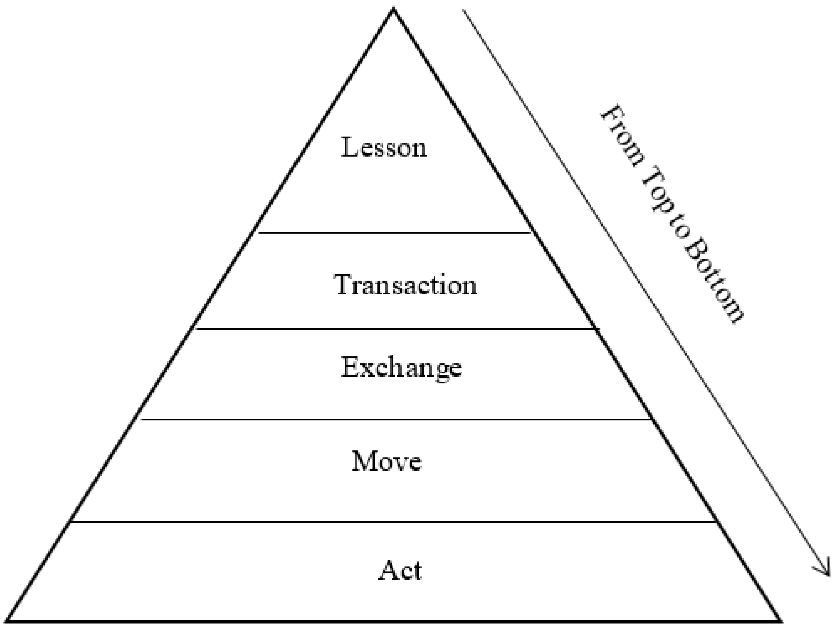


Figure 11: The descriptive system of classroom discourse (Sinclair and Coulthard, 1975)

As *Figure 11* illustrates, each unit of classroom interaction above the lowest are made up of one or more components from the unit immediately below on the rank scale. For example, the highest unit ‘Lesson’ consists of one or more activities or ‘Transactions’ (Sinclair and Coulthard, 1975).

The most outstanding contribution of Sinclair and Coulthard’s work (1975) is the identification of the structure of discourse exchange (Eggins and Slade, 2005, Cummings, 2010). As the hierarchical system shows, an exchange is broken down into moves. Coulthard and Brazil (1992) define an exchange as “the unit concerned with negotiating the transmission of information” (p.74). An exchange can be seen as the unit of information produced through a minimal unit of interaction that occurs between two individuals (Coulthard and Brazil, 1992, Stubbs, 1983). An exchange might be composed of: statement (I) and counter-statement (R), question (I) and answer (R), or offer (I) and acceptance (R) (Pilkington, 1999).

According to Sinclair and Coulthard (1975) the Exchange structure can be divided into two major classes: Boundary and Teaching exchanges. While the boundary exchange has the function of signalling the beginning or the end of a phase of activity through a *Focusing* move (e.g. today..) and a *Framing* move (e.g. well), the teaching exchange refers to specific steps by which the activity progresses by means of some moves such as *informing*, *directing* and *eliciting* (p.49). The model suggests that the most common and frequent exchange structure that occurs in a classroom, which is adequate to describe a question-answer exchange, is [I R <F>]. Sinclair and Coulthard (1992, p.3) stated that "A typical exchange in the classroom consists of an *initiation* by the teacher, followed by a *response* from the pupil, followed by *feedback*, to the pupil's response from the teacher".

Teacher: *What is the capital of the United Kingdom?*	I
Student: *It is London*	R
Teacher: *That is correct*	F

Example 6: [I R <F>] Exchange Structure

However, there are some limitations of the [I R <F>] Exchange Structure and it has been subjected to criticism. It was produced in a highly formal learning environment that was dominated by the teacher (Brown, 2010, Strobelberger, 2011). This type of environment requires students only to respond and recite the answer (Candlin and Mercer, 2001). The format of [I R <F>] totally prevents students from being empowered to control their learning and restricts their opportunities to be involved in meaningful discourse (Candlin and Mercer, 2001). McCarthy (2001) argues that the three-part structure does not describe the situation where the participants are equal and have the same authority, such as peer-to-peer talk. Another criticism of the model is that it can be problematic to determine the boundary of exchange, when applying it to a complex dialogue where we have a major piece of information (Coulthard and Brazil, 1992). In addition, there are some circumstances where we need to deal with the problem of understanding the meaning of an utterance (Sidnell, 2010). In such a situation, a repetition or further clarification is essential in order to understand the preceding utterance (Tsui, 1994).

The limitations of Sinclair and Coulthard's three-part structure (1975) led Coulthard and Brazil (1981) to replace the third element 'feedback' by 'follow up'. Coulthard and Brazil (1981) state that, "in reconsidering the three element of structure and their definitions we will now use the structural label ‘follow-up’ for the third element to avoid any semantic implications” (p.97). For example, any acknowledgment move should be classified as ‘follow-up’ rather than feedback. They extended the model to include whether an utterance is predicted from a previous turn or predicting another turn. Another notable contribution made by Coulthard and Brazil (1981) is that they highlight the need for a fourth element of exchange to describe a situation when an utterance is predicted and predicting.

		Predicting	Predicted
1	Initiation	Yes	No
2	Response	No	Yes
3	Follow-Up	No	No
4	?	Yes	Yes

Table 4: The prediction matrix of Coulthard and Brazil

(1981, p.97)

Coulthard and Brazil (1981) labelled the fourth element as Response/Initiation (R/I) which can be seen as both a response (R), with regard to the previous utterance, and as an initiation (I), with respect to the next turn. For example,

Teacher: *Can you tell me what that means?*	I
Student: *Does it mean danger men at work?*	R/I
Teacher: *That is correct*	R

Example 7: R/I turn in Coulthard and Brazil

(1981, p.97)

As Table *4* illustrates, the fourth element R/I was defined as both predicting and predicted. Stubbs (1983) revised the definition of Coulthard and Brazil (1981) with respect to the prediction of the R/I turn. Stubbs (1983) extended the study of Exchange structure’s elements to specify whether an utterance is *Initial* or *Terminal*. Stubbs (1983) shows there are different possibilities and concludes that, “Since R/I is defined as predicted, but the prediction of I is already fulfilled by R which makes no further prediction……an utterance cannot be both initial and predicted” (p.138 & p.139). As Table *5* shows, Stubbs’ matrix includes the element of

Reinitiating (Ir), which is not initial but it is predicting a following turn. Also, Ir is not predicted from the previous utterance.

	Predicting	Terminal	Predicted	Initial
I	+	_	_	+
R	_			_
F	_			
Ir	+	_	_	_

Table 5: Stubbs' matrix

(1983, p.138)

According to Pilkington (1999), we can use Reinitiating (RI) to identify a situation where argumentation takes place because "it is reserved for clarification, checking and challenging style inquiries or negotiation followed by justification, typical of repair work of critiquing" (p.8). It could be said that the argumentation process might include different interactional behaviours, within the current exchange structure, aiming at resolving a dispute and reaching the final conclusion (Henkemans et al, 1997, Walton, 2013).

Pilkington (1999) proposed a scheme of analysis called DISCOUNT scheme which can be employed for the analysis of Exchange Structure. The DISCOUNT scheme was based on the previous work of Sinclair and Coulthard, (1975) and Stubbs (1983). The DISCOUNT scheme replaced the element F *feedback* with Response-Complement (RC) in order not to be confused with the *feedback* move that takes place in a lower level of analysis. RC can be defined as a contribution that might carry feedback, evaluation or acknowledgment and show the intention to close the current exchange. By employing the Exchange Structure Analysis (ESA), we can identify participants' Exchange structure roles such '*initiator*' and '*responder*' which, in turn, determines the active and passive participants. In addition, Pilkington (1999) employs the terms: Stand-alone (SA) and Neutral (N) that can identify the active and passive participants. While Stand-alone (SA) describes a situation where a sequence of turns is made by the same participant, Neutral (N) can be gestures that signal to the active participants to continue. According to Kneser et al, "ESA is aimed at capturing the grammar of turns between dialogue participants with the aim of gaining insights into their relative contributions and roles" (2001, p.67). A turn can be defined as a contribution that begins and ends by a particular speaker at a specific time (Sacks et al, 1974). Table *6* illustrates the Exchange Structure categories proposed by Pilkington (1999) with the description of each element.

Code	Category	When exchange is well formed				Descriptions
		Initial	Predicting	Predicted	Terminal	
I	Initiate	Yes	Yes	No	No	Initial turn of exchange
R	Respond	No	No	Yes	can be	comments on a previous turn or answering a question
RI	Re-Initiate	No	Yes	No	No	Comments on a previous turn that anticipate a response critiquing/inquires
RC	Response-Complement	No	No	No	can be	Comment on a response that can include a feedback or acknowledgment
N	Neutral	No	No	No	No	e.g. 'um', 'er-hu' or nods of the head
SA	Stand Alone	Describe a sequence of turns for active/passive determination				A sequence of turns made by the same participant

Table 6: Exchange Structure categories proposed by Pilkington (1999, p.21)

The DISCOUNT scheme presented by Pilkington (1999) combines ESA with the analysis of *Moves* at different levels to capture the pragmatic intentions of participants' turns (Chapter 4, section *DISCOUNT scheme*, explains the DISCOUNT scheme in further detail).

I would say that, when users interact with Botocrates, the role (responder, initiator or re-initiator) adopted by Botocrates differs according to the current goal of the interaction. While the exchange structure of a particular information-seeking task requires Botocrates to act like a responder in order to achieve the user's goal, the user's engagement in the argumentation process needs Botocraetes to shift the role and to act like an initiator (e.g. probing the user's opinion) and re-initiator (e.g. asking for clarification, checking, challenging, and critiquing). The dialogue process of Botocrates should take into account that the role of Botocrates within a specific exchange structure has to lead to achieving the final goal of interaction. Through interaction, Botocrates and users should be able to exchange information in a meaningful way and their contributions have to show coherency in sequence of a certain exchange structure (Stephanidis, 2009). As explained above, the argumentation process involves a more complex exchange structure and, therefore, the dialogue strategies have to be more dynamically responsive in order to react according to different conversational behaviours (Jokinen, 2009). During the argumentation process, each party (Botocrates or the user) develops the argument structure through the course of argumentative exchange (Van Eemeren et al, 2007).

Exchange Structure Analysis (ESA) in Synchronous Text-based Online Dialogues

The purpose of this section is to explore the potential advantages of ESA in text-based interaction. While the facilitators of online dialogues are concerned with the quality and the quantity of students' engagement in online chats (McBrien et al, 2009, Duncan et al, 2012, Meyer, 2014), the use of ESA in conjunction with intentional acts analysis can be a powerful tool for tracking and exploring participants' interactions in online dialogues (Kneser et al, 2001, Pilkington and Walker, 2003b, Lim and Sudweeks, 2008a, Guldberg and Pilkington, 2007, North et al, 2008, Kitade, 2012). Understanding the structure of exchanges in text-based chat can help in both examining the nature of students' interaction (the first stage of the research) and building and evaluating Botocrates' dialogue model (the second stage of the research) (Pilkington, 1999).

From a constructivist perspective, Kneser et al (2001) utilized ESA to evaluate tutor and postgraduate students' interactions in eight online chats. The study found that ESA is a useful method for examining the inclusiveness of online chat and the distribution of participants' roles during the discussions. By tracking the tutor and students' participations using ESA, Kneser et al (2001) were able to explore to what extent the tutor was the dominant one during the chat. In order to transfer discussion skills to students, the study concluded that the tutor should transfer the control to students by fading from the chat rather than being the main dominant participant. However, students might lack the basic and essential skills to facilitate the discussions (Driver et al, 2000, Halpern, 2003, Andrews, 2010), therefore, further scaffolding is needed (Pilkington and Walker, 2003a). In addition, Kneser et al (2001) suggested that the proficiency of English language skills might affect and limit non-native speakers' contributions during the online chat.

Pilkington and Walker (2003a and 2003b) applied ESA alongside the analysis of moves to examine the improvement in students' argumentation skills in online synchronous chats. By comparing students' Exchange Structure roles in the first session with the final session, ESA of the last session showed the development of students' engagement with each other's contributions. While the chat of the first session was not coherent and students were not addressing each other's points (as the number of initiating turns (I) represented high proportion compared with responding (R) and reinitiating (RI) turns), the final session shows improvement of the numbers of reinitiating (RI) turns and consistency between initiating turns (I) and responding (R).

The study of Cox et al (2004) adopted ESA in combination with the analysis of a handful of *Moves* to compare and evaluate the use of synchronous online chat in two different blended courses. One of the aims of the study was to examine the distribution of students' turns and the inclusiveness of the online chats interactions. Cox et al (2004) found that although the distribution of students' turns was incompatible, the quality of interactions of both courses improved over time. However, the study pointed out that the skills and the experiences of facilitating the online chats were the key elements that affected students' contributions. Lim and Sudweeks (2008a) suggested some factors that might either encourage or limit students' participations in online chats such as "presenter roles, facilitation style, assessment, and turn-taking behaviour" (p.181). Lim and Sudweeks (2008b) examined the effectiveness of online synchronous chat in terms of knowledge construction. Lim and Sudweeks (2008b) applied ESA to explore the impact of participants' interaction in online chat on the learning process. The findings of their study suggested that the topic development within exchanges can give an indication to what extent participants are involved in information sharing and meaning negotiation.

The findings of previous studies suggest the contributions of participants are affected by the abilities and the skills of the e-mediators. It can be argued that one of the main issues that the facilitators of online chat have to take into account is the management of a turn-taking system. Sidnell (2010) argues that the opportunities of participants to contribute in conversations could be distributed by the dynamic of turn-taking. The development of any topic within an exchange is affected by the unit of conversation called 'turn'. Sacks et al (1974) state that,

> the turn is a unit whose constitution and boundaries involve such a distribution of tasks as we have noted: that a speaker can talk in such a way as to permit projection of possible completion to be made from his talk, from its start, allowing others to use its transition places to start talk, to pass up talk, to affect directions of talk etc., and that their starting to talk, if properly placed, can determine where he ought to stop talk. That is, the turn as a unit is interactively determined
>
> (Sacks et al, 1974, p.727)

3.3 Turn-Taking

As the mechanism of turn-taking is seen as a key factor in shaping and developing particular exchange structures and the structure of the entire conversation (Sacks et al, 1974, Drew and Heritage, 1992, Atkinson et al, 2008, Sidnell, 2010), this section explores turn-taking and the characteristics of the exchange of turns in synchronous online text-based chats. The purpose of this section is to help in identifying how the conversational floors can be established and developed to accomplish Botocrates' tasks. Different types of turn-taking mechanisms produce different types of conversational floors (Sacks et al, 1974, Edelsky, 1981, Franck, 1985).

Turn-taking studies stem from the Conversation Analysis (CA) approach which focuses on when and how participants take turns during conversation (Cook, G. 1989, Mayers, C. 2008, Burns and Coffin, 2013). While a turn is seen as the basic unit of talk (Sidnell, 2010), the turn-taking system describes how these basic units are organized (Sacks et al, 1974). According to Sacks et al (1974), turn-taking in talk is "locally managed, party-administered, interactionally controlled, and sensitive to recipient design" (p.696). In other words, turn-order and turn size are not predetermined but rather they are constituted and shaped during the interactions between participants which might be affected by "a multitude of respects in which the talk by a party in a conversation is constructed or designed in ways which display an orientation and sensitivity to the particular other(s) who are the co-participants" (Sacks et al, 1974, p.727).

The description of the turn-taking system was divided by Sacks et al (1974) into two components: the turn-constructional component and the turn-allocation component. Turns in conversations are made up from Turn-Construction units (TCUs) that might comprise a single-word (e.g. why?), a single-phrase (e.g. until when?) or a single-clause (where is it?) (Wooffitt, 2005, Sidnell, 2010). When two turns are mutually related and they depend on each other such as question/answer or greeting/greeting, they are called 'adjacency pair' (Schegloff and Sacks, 1973, Sacks et al, 1974). For example,

A: *Hi!* (First pair part FPP)

Botocrates: *Hello there* (Second pair part SPP)

Example 8: Adjacency pair

As *Example 8* illustrates, the basic form of an 'adjacency pair' is characterized by some features: (a) it consists of two turns, (b) it takes place between different interlocutors, (c) it is adjacently placed and well-ordered as one after another (d) it is properly related and coherent (Schegloff, 2007). It could be said that the structure of adjacency pairs differs from one setting to another, and the different roles within the settings might generate different structures (McCarthy, 1991). However, sometimes the adjacency pairs are difficult to be tracked as they might be separated by an ‘insertion sequence’, which refers to utterances placed between the first pair part and the second pair part and interrupt their adjacency (Pridham, 2013). For example,

A: *Shall we go by car or by train?* (First pair part FPP)

B: *Have you got a car?*

A: *Yes I have*

B: *Congratulations*

Insertion sequence

B: *Okay, let us go by car!* (Second pair part SPP)

Example 9: An insertion sequence

In the case of ‘problematic understandings’, we might find some circumstances where the second pair parts (SPP) are either inappropriately stated or not properly understood which require the interlocutor of the first pair part (FPP) to initiate another following repair turn called ‘third position part’ (Schegloff, 1992, p.1301). Sidnell (2010) defines ‘Repair’ as, “an organized set of practices through which participants in conversation are able to address and potentially resolve such problems of speaking, hearing or understanding” (p.110). For example,

Teacher: *our lesson today is about HCI*

Student: *I know, this abbreviation stands for Human Computer Interaction*

Teacher: *No, I mean the chemical component.*

Student: *Oh,,, It is Hydrochloric acid* (Schegloff also gives a possible fourth repair position see Schegloff 1992)

Example 10: Repair for solving the problem of understanding

According to Levinson (1983) and Schegloff (2007), there are some circumstances where the second pair part is dispreferred which can cause disagreements or misunderstandings between speakers which, in turn, lead to the expansions of adjacency pair structures. It could be said that the consecutive expansion of adjacency pairs can be seen as an argumentation process that attempts to solve the disagreement between speakers (Jackson and Jacobs, 1992, Gruyter, 1987, Putnam and Roloff, 1992, Fetzer and Meierkord, 2002). Nevertheless, not every expanded adjacency pair contains disagreement or an argumentation (Van Eemeren, 1987). Schegloff (2007) identifies different forms of the expansions of adjacency pairs: pre-expansion, insert expansion and post expansion, which sometimes reflect the politeness of speakers rather than disagreement (Van Eemeren, 1987, Davies and Elder, 2008).

Pre-expansion

A: First pair part

Insert-expansion

B: second pair part

Post-expansion

Figure 12: Repair for solving the problem of understanding

(Schegloff, 2007, P.26)

In terms of the allocation of turns, Sacks et al (1974) illustrate two alternative options for selecting the next speakers which are: (a) the current speaker selects the next speaker or (b) the next speaker selects him/herself in what is called ‘self-selection’ (p.703). According to Sidnell (2010) these rules organize the distribution of turns among participants in conversation. In addition, the transition of turns occurs when the Transition-Relevant Place (TRP) is reached which indicates the point of possible completion of a turn (Garcia, 2013). The TRP refers to the point of a turn that signals a possible change in speakers which might give the opportunity to the other participants to hold the floor (Baker and Ellece, 2011). The ‘floor’ in conversation is defined as “a sustained focus of cognitive, verbal, and nonverbal attention and response between speaker and audience” (Erickson, 1982, p.47). It is recognized at the higher level of dialogue structure; higher than the level of turn and move (Hayashi, 1996). The conversational floor is seen as an essential element for topic cohesion during a conversation (Erickson, 1982, Simpson, 2005a). Hayashi (1996, p.31) defines the floor as “a cognitive entity that the interactants jointly create during the course of conversation”.

However, there are some situations where the TRPs are difficult to be identified, (e.g. because of the absence of verbal and visual cues), that may cause overlapping between turns (Witczak, 2013). Sacks et al (1974) illustrate that overlapping between participants in conversation occurs in self-selection turns, when a speaker selects her/himself to speak before the ending of the current turn.

In addition, grabbing or passing the floor can be achieved by the use of some words such as well, but, so, now etc. (Wheeldon, 2013). For example, A: *Shall we go to the school this week. I think…..*

B: *Now, let us finish and then we will decide*

Example 11: Changing the floor

Example 11 shows how the use of 'now' not only serves as grabbing the floor from speaker A, but also shifting the attention away from what is said (Wheeldon, 2013). However, this might be the case in spoken conversations which differ from synchronous text-based chat as we will find in the next section.

We have to bear mind the difference between casual conversation and institutional conversation. Institutional conversation refers to any conversation shaped by "(1) participants' orientation to goal, task or identity, (2) special and particular constraints, and (3) frameworks and procedures that are particular to specific institutional contexts" (Drew and Heritage, 1992, p.22). The interaction between participants in institutional talks can be described as asymmetrical interactions as a result of the differences between their roles, the levels of their knowledge and their authorities (ibid). Generally, conversations that occur in classroom settings can be seen as a form of institutional conversations (Nguyen et al, 2009, Sidnell and Stivers, 2012). It could be said that the transition of turns in the classroom can be described as 'pre-allocated' (Ellis, 2012). McHoul (1978) argues that in classroom settings, turn-taking systems are 'heavily preallocated' which are dominated by teachers (p.211). The term 'preallocated' was coined by Sacks et al (1974) which describes the situation where one participant has more authority to allocate who speaks next. The preallocation turn-taking type occurs during the activities of asking and answering questions (Drew and Heritage, 1992, Clayman and Heritage, 2002), typically when one party has a predetermined role over the other participants (Heritage, 2005, Freed and Ehrlich, 2009).

Seedhouse (2004) points out that the organization of turn-taking inside classrooms varies depending on the pedagogical focus. For example, in his study that took place inside learning language classrooms he found the allocation of turns differs according to the teacher's plans or activities (e.g. accuracy, fluency, task-oriented and procedural context). While the mechanism of turns taking in learner-centred interactions can be described as locally managed between participants, teacher-led interaction could be seen as a preallocated turns taking type (ibid). However, Walsh (2013) stated that, "even in the most decentralised and learner-centred classroom, teachers decide who speaks, when, to whom and for how long. Teachers are able to interrupt when they like, take the floor, hand over a turn, direct the discussion, switch topics" (29). Walsh (2006, 2011 and 2013) suggests that the roles of participants during a conversation should be more equal in order to ensure a better engagement.

During the interaction with Botocrates, both parties (the agent and the user) can initiate a new floor. Each party can take the lead role during the dialogue process. Therefore, the tasks of Botocrates include dealing with floors initiated by users and initiating a floor that can engage users in the argumentation process. During the argumentation process, the development of the floor needs to be well-prepared and well-organized (Jackson and Jacobs, 1992, Gruyter, 1987, Putnam and Roloff, 1992, Fetzer and Meierkord, 2002). The words 'well-prepared' and 'well-organized' here are challenging since it is difficult to anticipate the entire possible users' communicative behaviours before Botocrates' dialogue strategies are implemented. The broader patterns of turns within a constructive structural expansion have to be relevant and connected to the argumentation process (Jackson and Jacobs, 1992). Moreover, Botocrates requires dealing with any unrelated or off-task turns (Geis, 2006).

Turn-Taking in Synchronous Text-based Online Dialogues

The aim of this section is to explore the impacts of the mode of communication (text-based chat) on the mechanism of turn-taking.

The study of the organization of turn taking relies greatly on the analysis of spoken discourses. Therefore, not surprisingly, the exploration of the mechanism of turn-taking and adjacency pairs in synchronous text-based chats highlights some differences in comparison with spoken conversations (Herring, 1999, Simpson, 2005a, Simpson, 2005b, Anderson et al, 2010, Zaferanieh, 2012). It could be argued that the special features of the mode of communication play a crucial role in determining the nature and the mechanism of the turn-taking system (Reyes and Tchounikine, 2004, Bente and Krame, 2011). For example, the lack of verbal and visual channels such as voice intonation and facial expression in online text-based chat causes a change in the typical dynamic of turn-taking transitions (Yang, 2012, Rada and Michailidis 2012). Simpson (2005b) suggests that the disruption of turns' order in Synchronous Computer Mediated Communication (SCMC) is due to the lack of 'fine tuning' (p.343). The 'fine tuning' of interactions in SCMC are affected by the fact that: (a) turns do not appear on the screen until after being sent, and (b) there are no visual and verbal cues (ibid).

While ideal transitions between turns in spoken conversation occur without gap or overlap (Sacks et al, 1974) and turns are adjacently placed and well-ordered (Schegloff, 2007), Herring (1999) points out that the adjacency pairs in SCMC can be described as disrupted and not adequately coherent. Herring (1999) attributes the popularity of SCMC, despite the loosened coherence, to: (a) the capabilities of users to adopt the medium, and (b) the impact of incoherent content on increasing the interactivity. Simpson (2005b) suggests that describing the online text-based chat as not coherent is clearly a contradiction because of its popularity (as claimed by Herring). Simpson (2005a and 2005b) argues that cohesion in SCMC is not reliant on the transitions of turn-taking (as it occurs in spoken conversation) but rather conversational floors can be described as magnets which attract and reorganise utterances so that the unity and meaning of turns can be comprehended.

It could be said that the abilities of participants to adopt the medium of text-based chats despite its unorganized interactions and the disruption of turn adjacency (Herring, 1999) lead them to rely on conversational floors as an alternative option (Simpson, 2005a). Simpson (2005b) explores the conversational floors in informal multiparty discourse that take place in SCMC. He divides conversational floors into three types: first, a speaker-and-supporter floor which describes the situation when one participant continues to hold the floor and the others are seen as supporters with short comments. The second type is a collaborative floor where the floor of conversation is created collaboratively by participants. Finally, a multiple conversational floor indicates the presence of two or more floors occurring at the same time side by side. In contrast to spoken interactions, it seems that the features of synchronous text-based chats enable participants to be engaged in multiple conversations (Simpson, 2005b, Zaferanieh, 2012, Pasfield, 2012, Jenks, 2014). According to Simpson (2005b), the medium's features such as being able to scroll up the screen and read previous participations facilitate the development of a multiple of conversation floors. In addition, the roles of participants, the topics and their underlying purposes can be seen as key factors that could affect the development of specific conversational floor types (ibid). However, Simpson (2005b) points out that not all SCMC settings have the same characteristics because the socio-cultural rules of a certain virtual community of practices should be taken into account. For instance, the topics in formal task-based interactions are predefined and any contributions that appear not directly related to topics could be labelled as off-task discussions (Meskill, 2013, Peterson, 2013).

Another distinct feature of the mechanism of turn-taking in text-based online chat is the special characteristic of Turn-Construction units (TCUs). Zaferanieh (2012) found that participants in online chat preferred to construct short and incomplete utterances rather than writing the whole sentences at once. It seems that participants try to cope with the rapid and continual transition of turns because any delay could make their turns occur at an inconvenient moment. By posting incomplete sentences, participants aim to signal that another turn is expected and their contributions are not yet finished in order to avoid a possible disruption caused by other turns (ibid). The delay in online text-based chat can be attributed to two reasons: (a) writing a contribution takes longer than just saying it and (b) the contribution cannot be seen until after being sent (Zaferanieh, 2012). It could be noticed that a single turn in online text-based chat may be composed only of a short utterance which does not give any meaning when it stands alone. Vandergriff (2010) states that, "the difficulty in interpreting messages in their sequential context arises from the fact that turn sequencing is partly user-controlled and partly system-controlled" (p.241). For example, Gibson (2014) suggests that the 'foreshadow' icon can affect the transition of turn-taking in text-based online chat as it indicates when a participant wishes to contribute and the participation is in process (p.72). The 'foreshadow' feature refers to the option of the software that shows that someone is writing before her/his contribution is sent (e.g. *Socrates is typing*). It could be argued that, while Sacks et al (1974, p.696) claim that the turns order and turn size are "locally managed, party-administered, interactionally controlled", another element could be added, in the case of online text-based chat, which is 'software-controlled' (Reyes and Tchounikine, 2004, Simpson, 2005b, Vandergriff, 2010, Bente and Krame, 2011, Zaferanieh, 2012, Gibson, 2014).

Even though there are notable differences between multiparty discourse interactions and one-to-one interaction, the study of natural language corpora of dialogues such as the logs of students' online seminars can be useful as a rich source of data for identifying argument patterns and schemes (Gelbukh, 2012, Cabrio et al, 2013). There are different tasks that Botocrates should perform during interaction with the users such as the generation and the development of argumentation, which need to be deduced from a context-relevant corpus (Andrew, 2010). Multiparty interaction can be broken down into a set of pairs of two parties' interaction which in turn can inform the design of Botocrates' dialogue model (Strauss and Minker, 2010).

3.4 Speech acts

The importance of speech acts in argumentations

This section explores the significance of speech acts for modelling dialogue. The interpretation of the meaning of utterances during conversation is considered a key element for determining the next sequential steps that lead to achieving the final goal of any dialogue (Bunt, 2000, Moubaidding and Obeid, 2008). Interpreting speakers' utterances can be obtained by focussing on the type of communicative action performed by speakers (Holtgraves, 2013, Yule, 2014, Kissine, 2013).

Edmondson (1981) defines interactional acts as the smallest conversational units that can describe the interlocutors' behaviours. A move consists of one or more acts (Sinclair and Coulthard, 1975). Walton (2003) argues that the goal of any dialogue can be successfully achieved by means of specific sequences of moves. In the case of argumentation where the structure of dialogue is seen as 'goal-directed structure', speakers' moves should aim at producing a relevant set of speech acts (Walton, 1992, p.5).

While the structure of argument contains a proposition or collection of propositions that either support or challenge the final claim, the expressions of these propositions are performed by particular speech acts (Jacobs, 1989). Van Eemeren (1987) suggests that speech acts could be described as the central units that constitute the organisation of argument. The functional analysis of speech acts during the process of argumentation is essential for the structure of argument (Jacobs, 1989), because it helps in deciding which argumentative move should be performed (Van Eemeren et al, 2007). The product 'argument' is performed by the use of language during the process of argumentation which contains explicit and implicit acts intending to resolve the dispute between interlocutors (Van Eemeren and Grootendorst, 2004). The performance of speech acts, therefore, should be felicitous and lead successfully to reconciling disagreement between speakers, otherwise, those acts might be infelicitous and prevent them from obtaining the desired outcome of the dialogue (Baroni et al, 2010). For example, fallacies during argumentations and rational discussions are seen as speech acts which, mistakenly, aim at resolving the disagreement between speakers (Van Eemeren and Grootendorst, 1984).

In order to promote students' argumentation skills, it is vital to prevent them from performing and accepting such communicative acts at any stage of argument (Van Eemeren and

Grootendorst, 1984). Searle (1969) describes these types of fallacies as 'assertion fallacies' which are "the fallacies of confusing the conditions for the performance of the speech act of assertion with the analysis of the meaning of particular words occurring in certain assertion" (p.141). As illustrated by Searle (1969), the identification of an assertion fallacy cannot be determined by only looking at specific words, but the justification of the performance of such speech acts and its warrant must be taken into account. In argumentation, some speech acts, such as assertions have a particular condition to be formed (Fann, 2013) and, therefore, we have to bear in mind the importance of satisfying the condition of each speech act (Grewendorf and Meggle, 2012). For instance, in the case where the speaker asserts something, she/he has to fulfil the precondition for the assertive communicative acts such as stating supportive evidence or a valid reason (ibid). When the assertive speech acts fail to satisfy the preparatory condition by not being followed or preceded by supportive evidence, then it must be encountered by the speech act 'challenge' that defeats the other party's assertion (Walton, 2013).

The pragma-dialectical theory suggests that any critical discussion (persuasive argument) can be seen as a part of the exchange of points of view between two speakers who hold two dissimilar opinions or beliefs about a certain case (Van Eemeren et al, 2007). In order to resolve the disagreement between the two parties, there are four stages of the argumentation process which are: confrontation stage, opening stage, argumentation stage and concluding stage (Van Eemeren et al, 2007, p.10). Moving from one stage to the others during the argumentation process can be conducted by particular speech acts distributed among the four stages (ibid).

In the confrontation stage of argumentative discourse, the second party states clearly that the first party's point of view is not acceptable. The confrontation stage occurs when the second party states, for example, *the analogy is not valid* (assertive). Without the confrontation step the dialogue cannot be described as an argumentative one. When the first party states a claim, in fact she/he presents an assertive speech act. Assertive speech acts indicate that the speaker takes a specific position. Taking a position must be followed by a commitment to present supporting evidence and reasons otherwise the claim could be described as an assertion fallacy (Searle, 1969). The failure to accomplish the commitment of taking a position facilitates the occurrence of the opening stage in argumentation (Van Eemeren et al, 2007). As illustrated in Chapter 2, section *Argument and Academic argumentation*, the commitment of claiming something includes stating the grounds and considering the warrant of the claim. In the opening stage, both parties are engaged in a meaningful conversation and work together by means of sharing knowledge including challenging the other party to defend her/his points of view (directive) and the acceptance of the challenge (commissive) which indicates the engagement of both parties in exploratory talk (Mercer, 2000). Within the argumentation stage, the argumentation process shows that it is clear that the first party has a valid reason and supporting evidence when refuting any doubts about her/his points of view. The concluding stage ends with either resolving the disagreement between the parties or not. When a new dispute or disagreement appears, both interlocutors must show the obligation for carrying out the four stages again (Van Eemeren et al, 2007). Table *7* illustrates the distribution of speech acts among the four stages of a critical discussion.

Stages of a critical discussion	Speech acts
Confrontation	Assertive, commissive, directive and usage declarative
Opening	Directive, commissive, directive and usage declarative
Argumentation	Directive, assertive, commissive, directive and usage declarative
Concluding	Commissive, assertive, directive and usage declarative

Table 7: Distribution of speech acts among the four stages of a critical discussion

(Van Eemeren et al, 2007, p.16)

As noticed in this section, the development of the argumentation process that may occur between Botocrates and users is carried out through interactional acts. Identifying the dialogue acts that could reflect the nature of dialogues is a crucial matter in order to control the flow of the dialogue and to accomplish the goal of interaction (Beveridge and Milward, 2003, Andrews and Quarteroni, 2011). The capability of the system to control the flow of the dialogue and select the best dialogue strategies relies on the identification of the user's current interactional act (Neel and Minker, 2012).

Moves and Acts in Sinclair and Coulthard's model (1975)

The lowest levels of the hierarchical model proposed by Sinclair and Coulthard (1975) comprise Move and Act. According to their descriptive system, Move consists of one or more Acts. Sinclair and Coulthard (1975) describe the relationship between Moves and Acts as the correlation between words and morphemes (e.g. the word unpredictable has three morphemes: un, predict and -able).

> Moves and acts in discourse are very similar to words and morphemes in grammar. By definition, move is the smallest free unit although it has a structure in terms of acts. Just as there are bound morphemes which cannot alone realize words, so there are bound acts which cannot alone realize moves.
>
> (Sinclair and Coulthard1975, p.23)

In classroom interactions, Sinclair and Coulthard (1975) observe five major categories of moves: framing, focusing, opening, answering, and follow-up moves which build up two classes of exchanges: boundary and teaching exchanges. Each particular move has its own function. Both framing move (e.g. 'now', 'right' and 'ok') and a focusing move (e.g. today we are going to…) are related to the boundary exchanges which indicate the start and the end of teaching exchanges (Sinclair and Coulthard, 1992). Focusing moves aim at introducing the course of actions and they are often preceded by framing moves. For example,

Teacher: *Right, Today we are going to discuss* ……..

Example 12: Focusing move

The functions of opening, answering, and follow-up moves are associated with teaching exchanges. Opening moves are aimed at triggering other participants to be engaged in the current exchange by means of eliciting opinion or fact, directing the activities or merely passing information. The opening moves sometimes are followed by another possible class of moves such as bid and nomination before students' answering moves. Students' responses are usually followed by follow-up moves which have the purpose of accepting, evaluating or commenting on students' performances. Sinclair and Coulthard (1975) note that prompt and clue moves might happen after the opening move and before students' responses. Those moves were later classified by Pilkington's scheme (1999) as facilitating activity functions which can indicate asymmetrical interactions in terms of the levels of knowledge.

Sinclair and Coulthard (1975) identify three main acts which might take place in a conversation: elicitation, directive, and informative. In classroom interactions, these acts seem to be "as the heads of initiating moves" (Sinclair and Coulthard, 1975, p.28). The purpose of an elicitation act is to request from students a response by asking a question followed by a reply act from students. The directive acts could be instructions to be performed by students which do not necessarily provoke verbal responses (e.g. let us move on to the second task). The informative acts aim at providing students with information such as opinion or facts. Sinclair and Coulthard

(1975) suggest that elicitation, directive and informative acts could be identified by a question (interrogative), a command (imperative), and an informative (declarative) respectively. Their classifications of acts were based on their functions. Sinclair and Coulthard (1975, p.14) state that,“ we are interested in the function of an utterance or part of an utterance in the discourse and whether it is intended to evoke a response, whether it is a response itself, whether it is intended to mark a boundary in the discourse”.

Sinclair and Coulthard (1975) add eleven subcategories related to free and bound exchanges in order to cover the additional and different possibilities of initiated exchanges. The additional categories take into account whether the initiation move was produced by a teacher or a student. While the free exchange has four major functions: informing, directing, eliciting, and checking, the bound exchange is connected to the previous teacher’s elicitation and directive acts (e.g. nominating a student, prompting or giving a clue). Table *8* below summarises the classes of moves and acts suggested by Sinclair and Coulthard (1975).

Exchange	Moves	Acts	Functions
Boundary	Framing	Marker	Indicate the start and the end of teaching exchanges
	Focussing	Marker/Conclusion/Statement/Metastatement	
Teaching	Opening	Inform	Passing information (facts or opinion)
		Direct	Ask student to do something
		Elicit	Asking a question to elicit information
		Cue	A command but not a directive
		Clue	Helping students with additional information
		Nominate	Selecting a student to answer a question
		Check	Check the readiness of students
		Prompt	Command to reinforce elicit and direct act
	Answering	Bid	Bidding to be selected
		Reply	Answering teacher’s question
		React	Response to teacher’s directive act
	Follow-up	Accept	Confirmation of receiving the answer
		Evaluate	Assessing and evaluating student’s answer

Table 8: A summary of the classes of moves and acts proposed by Sinclair and Coulthard (1975)

As we can notice, the classes of moves and acts in Sinclair and Coulthard (1975) appear to disregard the possibility in which the answerer might reject or challenge the previous question (Burton, 1981). Burton (1981) revised the model to include *challenge* moves which “hold the progress of that topic” because they are not predicted from the previous turn (p.71). Moreover, Sinclair and Coulthard (1975) argue that an elicitation is followed by a response or reply which can be identified by a statement. This observation of Sinclair and Coulthard (1975) is a result of the highly structured dialogue inside teacher-led discussion in a traditional classroom which does not reflect the case in argumentation because in dialogue 'both speakers are related to each other like a subject and the object in proposition', but in dialect, 'reason is both the subject and the object of the critique' (Singh, 2000, p.263). In this respect, Edmondson (1981) notes that an eliciting act must not necessarily be followed by a statement or informative act, but we might find a situation where an elicitation is countered by another elicitation act. There are some circumstances where we need to deal with the problem of understanding the meaning of an utterance (Sidnell, 2010). In such a situation, a repetition or further clarification is essential in order to understand the preceding utterance (Tsui, 1994). Also, an elicitation could be followed by a new and unrelated initiating turn (Coulthard and Brazil, 1992). For example,

A: *What does an argument mean?*

B: *Do you mean in a social or an academic context?*

A: *Sorry. My son is calling. Can I answer the phone?*

Example 13: Unrelated initiating turn

It could be said that, in order to design dialogue strategies that aim at accomplishing specific tasks, Botocrates' dialogue strategies should include both task-oriented moves and control moves (Bunt, 2000, Taylor et al, 2000, Lester et al, 2013, Devault and Stone 2014). While task-oriented moves help in engaging students in the argumentation process, the control moves are used to control the interaction. Considering these two types of move is vital for any mixed initiative and task-oriented system (Andrews and Quarteroni, 2011). In a mixed-initiative dialogue the user and the system can initiate a turn (Blandford, A. 1995, Karat et al, 2002, Woolf, 2010).

The development of Speech Acts Theory by Austin, Searle and Grice

The aim of this section is to explore the foundations and theories of speech acts in order to design the dialogue strategies and protocols that could help in achieving the tasks of Botocrates (Walton, 1998, Zarefsky, 2014). Modelling dialogue requires a better understanding of the language used and its interpretation in an interactive dialogue (McTear and Raman, 2011, Kobsa et al, 2012). Botocrates has to be able to recognize the conversational acts performed by users and act accordingly, which relies on how users' utterances are interpreted (Jokinen, 2009, Fabian et al, 2011a).

Austin is widely seen as the father of speech acts theories who established the foundation of the theory and made it the cornerstone of further development by Searle and Grice (Alston, 2000, Flor and Juan 2010). The initial study of different types of utterances and variable statements led Austin (1962) to differentiate between two types of utterances: constative and performative. The two terms formulated by Austin established the core of speech act theory, in particular, when he made a distinction between uttering something and *doing things with words*. First, a constative utterance refers to a situation where an interlocutor describes or states a fact e.g. '*Abdul is in his room'*. This type of utterance can be either 'true' or 'false'. Second, a performative utterance indicates the performance of an action when an interlocutor says something e.g. '*I apologize*' (Austin, 1962). The performative utterance can be characterized by:

> A. they do not 'describe' or 'report' or constate anything at all, are not 'true or false'; and
>
> B. the uttering of the sentence is, or is a part of, the doing of an action, which again would not normally be described as saying something
>
> (Austin, 1962, p.5)

The action of performing performative utterances can be described as "felicitous or infelicitous" (Austin, 1962, p.22), "appropriate or inappropriate" (Beale, 1987, p.92), "successful or unsuccessful" (Gruber, 2014, p.12). Describing a particular acts as felicitous or not is based on satisfying certain conditions in connection with its context (Austin, 1962). When the felicitous conditions are not obtained the performance of such acts could go wrong or be unsuccessful. For example, the act performed in the utterance '*switch off the lights'* is described as infelicitous if the lights are already switched off. Similarly, we cannot challenge someone's position without a certain position being already taken. As illustrated earlier, see section *The importance of speech acts in argumentation*, in the case of argumentation, utterances should aim at fulfilling the felicitous conditions of a particular speech act (Van Eemeren et al, 2007, Hample, 2006).

However, the initial classification made by Austin could '*go wrong*' in different circumstances. I used the expression '*go wrong*' as he preferred it to describe any utterance that is infelicitous. Let us take this example,

My supervisor: *Can we meet in the common room?*

Abdul: *The common room is locked.*

Example 14: Implicit request

In the example above, the utterance '*the common room is locked'* is constative but at the same time it carries an action and an implicit request to suggest a different room for the meeting. Likewise, if I said: '*the common room is locked*' to the receptionist of the school, the utterance performs an action of request to open the door of the common room.

> But I do not want to say that there is or is not any parallel here; only that at least there is a very close parallel in the other two cases; which suggest that at least in some ways there is danger of our initial and tentative distinction between constative and performative utterances breaking down.
>
> (Austin, 1962, p.54)

Another example:

My supervisor: *I suggest that you go to Saudi Arabia for a holiday*

Or

My supervisor: *You may go to Saudi Arabia for a holiday!*

Example 15: Implicit action

While in the first utterance '*I suggest that you go to Saudi Arabia for a holiday'* the performative verb is explicit *(I suggest that),* the second utterance implements an implicit action and performs the same speech act (*suggest)*. Not all performative utterances contain performative verbs that clearly name the performed action. Austin (1962) states that,

> Now we failed to find a grammatical criterion for performatives, but we thought that perhaps we could insist that every performative could be in principle put into the form of an explicit performative, and then we could make a list of performative verbs
>
> (Austin, 1962, p.91)

Austin (1962) developed the initial classification of performative utterances to three main types of speech acts: locutionary (the act *of* uttering something), illocutionary (the act *in* uttering something), and perlocutionary acts (the produced consequences or effects of the performed act).

For example,

Locution:

My supervisor: *'you should try to present in conferences'*.

Illocution:

She advised me to go to conferences.

Perlocution:

She persuaded me to go to conferences.

Example 16: Three main types of speech acts (Austin, 1962)

According to Austin in order to identify what illocutionary act is made we have to identify the way of using the language when presenting the locution. Identifying the illocutionary acts or the interlocutor's pragmatic intention when saying something plays an important role in the analysis of utterances (De Almeida, 1985, Wagner, 2006, Macagno, 2015). Despite the notable work made by Austin, his theory lacks clear criteria of classification when dealing with different content (Searle 1969 and 1971, Ghosh, 2008, Laningan, 2012). Austin himself acknowledged this limitation of his theory by stating that, "the real conclusion, we need to distinguish between locutionary and illocutionary acts, and specially and critically to establish with respect to each kind of illocutionary act" (Austin, 1962, p.145).

Searle (1969) claims that in order to have a reasoned classification of illocutionary acts without being at risk of overlap categorisation, we have to make a clear distinction between illocutionary verbs and illocutionary acts, which Austin failed to make. Searle (1969) claims that an illocutionary verb (e.g. announce or hint) sometimes only indicates the manner of performing a particular illocutionary act. Searle (1969 and 1985) developed the classification made by Austin and proposed a categorisation of illocutionary speech acts or "the act *in* saying something" (Austin, 1962, p.99). The central goal of Searle was to establish a systematic way of classification in order to offer criteria for making a rigorous distinction between different types of illocutionary acts.

> The production of the sentence token under certain conditions is the illocutionary act, and the illocutionary act is the minimal unit of linguistics communication.
>
> (Searle, 1971, p.39)

Searle (1985) argues that an illocutionary act is seen as the minimal unit of human interactions that consists of an illocutionary force *F* (the function of a particular utterance) and a propositional content *P* (the act of uttering an expression or a sentence under a particular circumstance), which are important indicators when identifying illocutionary acts. The identification of both the illocutionary force and propositional content of an utterance leads to determining what illocutionary acts are performed (Searle and Vanderveken, 1985). The illocutionary force of any utterance can be recognized within the syntax of the natural language in different ways such as "word order, stress, intonation contour, punctuation, the mode of verb, and the so-called performative verbs e.g. *'I apologize', 'I promise'* etc." (Searle, 1969, p.30). For instance, the three utterances: *'You will present at the PGR showcase conference', 'You, will present at the PGR showcase conference'* and *Will you present at the PGR showcase conference'* contain the same propositional content *P*, but the illocutionary force *F* of the first one is prediction and it is an order in the second utterance and the final one is inquiry. The syntactical feature of an utterance can determine its illocutionary force (Searle and Vanderveken, 1985). In a conversation, a speaker's intention is presented in an utterance that might encompass one or more illocutionary acts (Searle and Vanderveken, 1985). For example, *I will present in the PGR showcase conference, will you attend*?

However, in some situations the illocutionary acts and the forces can be performed implicitly and indirectly through another type of speech act (Searle, 1975, Searle and Vanderveken, 1985). For example,

My supervisor: *Can we meet on Tuesday next week?*

Abdul: *I have to go to Birmingham next week to attend a conference.*

Example 17: Indirect speech act (Searle, 1975)

In *Example 17*, the utterance '*I have to go to Birmingham next week to attend a conference*' includes two different types of speech acts: a) a non-literal and implicit primarily speech act (I reject your proposal as I cannot meet you on next Tuesday), and a literal and explicit secondary speech act in the utterance (*I have to go to Birmingham next week to attend a conference*). In such a situation, the literal meaning of the second utterance can only indicate the secondary illocutionary force while the primary one should be inferred by means of certain conversational rules and conventions (Searle, 1969, 1971 and 1979, Van Eemeren and Grootendorst, 1984, Vandenbergen et al, 2003, Geis, 2006).

Searle (1969 and 1971) and Searle and Vanderveken (1985) expanded the notion of the felicitous conditions of speech acts to determine different types of illocutionary force, which in turn indicates illocutionary acts. Based on the analysis of hundreds of English verbs in connection with their possible illocutionary forces (including non-synonymous verbs e.g. state and assert could mark the same illocutionary force), Searle (1969) suggests five basic categories of illocutionary acts: assertive, directive, commissive, expressive and declarative. The assertive speech act refers to the class of speech acts that commits the utterer, in some degree, to the reality of a certain case or the truth of a proposition (e.g. claim, assure, argue, report, inform, see Searle and Vanderveken, 1985). The directive speech act aims at requesting the hearer to do or to perform something (e.g. request, command, ask). Contrary to the directive speech act, the purpose of commissive acts is to commit the utterer to perform some actions (e.g. promise, consent, accept). The expressive speech acts refers to the act that expresses any acknowledgment such as congratulating and thanking or apologizing (e.g. welcome, congratulate, thank, and apologize). The point of declarative acts is to "bring about a change in the world by representing it as having been changed" (Searle, 2008, p.150), (e.g. approve, declare). We have to bear in mind that the pragmatic intentions of an interlocutor can be discovered not only by analysing single and isolated utterances (the micro level) but also the sequences of performed speech acts (the macro level) must be taken into account (Edmondson, 1981, Levinson, 1983, Van DiJk, 2010).

Similar to direct and indirect speech act theory introduced by Searle (1969), Grice (1975) proposed a new understanding of the meaning of an utterance. He argues that the meaning of an utterance might go beyond what a speaker literally says or *'what is said'* (Grice, 1975, p.307). The implicated meaning of an utterance or '*what is implicated'* (Grice, 1975, p.307), could be recognized by: a) a literal and semantic meaning, or by b) non-literal and pragmatic meaning. Grice (1975) coined the terms 'conventional implicature' to refer to the literal and semantic meaning of an utterance and 'conversational implicature' to indicate the non-literal and pragmatic meaning. For example, A: *I got my full driving licence; therefore, I can drive a car.*

Example 18: Conversational and Conventional implicature (Grice, 1975)

In the example above what is said is that he got his full driving licence and he can drive a car but the literal and semantic meaning conveys or implicates the conventional implicature that it is not legal to drive a car without a full driving licence. In such a sentence the derived meaning is based on the conventional and linguistic devices such as therefore, and, but etc. (Carston, 2008, Martinich and Sosa, 2008, Lepore and Stone, 2014). Similarly, the utterance: *Abdul is not a native speaker, but he can speak as Londoners do* implicates the conventional meaning that it is not expected from someone who is not a native speaker to speak as Londoners do. On the contrary, conversational implicature should be inferred from its context or the circumstance in which an utterance was said (Grice, 1975). It could be said that while a conventional implicature can be described as being context-independent meaning, conversational implicature can be referred as being context-dependent meaning (Birner, 2012, Frawley, 2013). For instance,

A: *Is there drinking water in the School of Education?*

B: *There is a common room at the end of this corridor.*

Example 19: Context-dependent meaning

In the example above the utterance '*there is a common room at the end of this corridor'* has no lexical and semantic meaning indicating A can find drinking water in the common room, but conversational implicature inferred from the utterance conveys that A can find drinking water in the common room. The conversational implicature of the previous utterance arises because, as suggested by (Grice, 1975), any conversation should be governed by a certain rule of cooperative principle or what he called conversation's Maxim.

> Make your conversational contribution such as is required, at the stage at which it occurs, by the accepted purpose or direction of the talk exchange in which you are engaged. One might label this the COOPERATIVE PRINCIPLE.

(Grice, 1975, p.45)

Grice's Maxim consists of four categories:

A. Quantity:

1. Making a contribution that is as informative as it should be for a certain goal of interaction.
2. The utterance should not be more than required.

B. Quality:

Supermaxim: Saying only what is believed to be true.

Other maxim

1. Not saying something that is believed to be false.
2. Not saying something without sufficient evidence.

C. Relation:

Making the contribution relevant to the goal of interaction.

D. Manner:

Supermaxim: Be perspicuous

Other maxim:

1. Avoid obscurity of expression.
2. Avoid ambiguity.
3. Be brief.
4. Be orderly.

(Grice, 1975, p.45 & 46)

The violation of these rules leads to the inference of conversational implicatures. In the example above '*there is a common room at the end of this corridor'* B flouted the maxim of being relevant and A inferred the implicature based on the cooperative principle. It could be said that the inference made by the hearer A plays the role of a scaffold that bridges the gap between what is said and what is meant by the speakers (Matsui, 2000, Wilson and Sperber, 2012). As suggested by Grice (1975) the speaker has to take into account the Maxims in order to be clearly understood.

It could be concluded that identifying users' communicative intentions is central to dialogue modelling because it enables Botocrates to successfully perform the correct dialogue acts (Jokinen, 2009, Berg, 2015). For recognizing users' interactional intentions, both the contextual elements and the structure of an utterance need to be taken into account (Landragin, 2013). In order to classify which conversational moves are performed by users, Botocrates could rely on the syntax features of utterances (e.g. word order and collocations), and the conversational structure (e.g. '*yes'* could be *accept* or *agree* moves based on the previous conversational moves) (Jurafsky et al, 1997, Jurafsk and Martin, 2009). Each conversational move implemented by Botocrates should be connected to the tasks of Botocrates (Traum et al, 2008, Andrews and Quarteroni, 2011). In addition, Botocrates should take into account Grice's maxims when producing a response to the user so that Botocrates' output can be well understood (Friedenberg, 2010, Hu et al, 2013).

3.5 Computational approaches to dialogue modelling

The aim of this section is to explore the computational approaches to dialogue modelling. Dialogue modelling can be defined as a branch of knowledge that investigates the structure and the process of dialogue in HCI (Jokinen, 2009, Bel-Enguix et al, 2009). Computational studies provide the foundation for building such a model that emulates the performance of human beings (Ginzburg and Fernandez, 2013). As we noticed earlier in this chapter, various linguistic theories contributed to my understanding of the structure and the process of conversations. Consequently, I found different approaches for modelling dialogues. There are three main approaches for building and designing a model of dialogue: a) grammar-based approach b) plan-based approach c) collaborative or joint action approach (Cohen, 1997, Kshirsagar et al, 2005, Josefa et al, 2006, Calking et al, 2007, Jokinen, 2009, Pietquin, 2004 and 2009, Moller, 2006). These approaches along with the advantages and disadvantages of each one are explored in the following sections.

Grammar-based approach

A dialogue grammar approach focuses on the rules that govern the mechanism and the structure of dialogue. These rules can be observed by exploring the "sequencing regularities in dialogue" (Cohen, 1997, p.253). The notion of this approach is similar to Chomsky's theory of the rules or the grammars that govern the structure of the sentence (Sinclair and Coulthard, 1975, Cohen, 1997, Kshirsagar et al, 2005). A grammar-based approach is based on the descriptive system of discourse units proposed by Sinclair and Coulthard (1975), Coulthard and Brazil (1992), and Stubbs (1983), and on turn-taking and adjacency pairs theories suggested by (Schegloff and Sacks, 1973, Sacks et al, 1974). Identifying the sequence of utterances in a dialogue leads to describing and modelling the whole structure of the dialogue from the start to the end (Kshirsagar et al, 2005). Modelling dialogue based on grammars requires terminal and non-terminal elements (Cohen, 1997). While exchange structure, e.g. initiate, re-initiate and respond, and adjacency pairs, (question/answer and greeting/greeting), describe the high level of dialogue structure or the non-terminal elements, conversational acts (Searle, 1969 and 1971) describe the lowest level of interactions or the terminal elements.

Initiation: *What is your name?* (Question)

Response: *My name is Botocrates* (Answer)

Adjacency pair

Example 20: A simple dialogue grammar

A dialogue grammar approach could be useful for modelling a simple dialogue for a well-structured task (Moller, 2006, Jokinen, 2009). Most of the dialogue models based on this approach are simple because the structure of the dialogues has fixed rules of pairing dialogue acts (Pietquin, 2004). In the case where the dialogue is more elaborate, it is difficult for the grammar rules or the transition states to deal with different situations and act appropriately (Mozgovoy, 2009, Jokinen, 2010). Among the practical concerns in a dialogue grammar model is to what extent the system could be based on clear criteria regarding how a system should correctly select a certain act for the next move (Cohen, 1997). To build a model of dialogue that communicates with users in natural language, the model must be able to deal with any utterances and take into account any miscommunication that may occur (Jokinen, 2009, Frederking, 2012). A grammar-based approach is not suitable for dealing with such situations that enable the system to take control of a complex dialogue structure and implement it accurately (Jokinen, 2010).

Plan-based approach

A plan-based approach is based on the assumption that an interlocutor has a particular intention which is to achieve a certain goal while the listener should discover this goal (Cohen and Perrault, 1979, Allen and Perrault, 1979). This approach to modelling dialogue is not only concerned with the direct goal but also with the potential hidden plan or the so-called "sub-goal" (Moller, 2006, p.28). A plan-based approach does not rely only on the semantic features of utterances but rather this approach pays more attention to the pragmatic goal. In contrast to the dialogue grammar approach, this approach is based on the observation that utterances are not only a collection of words (Cohen, 1997).

- People are rational agents who are capable of forming and executing plans to achieve their goals.

- They are often capable of inferring the plans of other agents from observing that agent perform some action
- They are capable of detecting obstacles in another agent's plans.

(Allen and Perrault, 1979, p.3)

Example 21 illustrates the notion of this approach:

Abdul: *Is Aisha's room in this building?*

The receptionist: *First floor, Room G.10.*

Example 21: Recognizing the speaker's plan

Even though it is yes/no question, if the receptionist answer was '*yes*', it would be unsuitable (Allen and Perrault, 1979), because it would flout the maxim of quantity as suggested by Grice's Maxims. The receptionist was able to realize the plan of the speaker and the obstacle in this plan, which was not knowing the location of Aisha's room. According to this approach, if the model was able to recognise speakers' plans, it could deal with indirect speech acts (Litman, 1985, Kshirsagar et al, 2005). Inferring the sub-goal of the speakers can be achieved by considering the context of the plan (Pietquin, 2009). This approach is more efficient than a dialogue grammar approach if we can ensure that the plan of the speakers correctly matches the listeners' plan (Moller, 2006, Pietquin, 2009). Therefore, the dialogue model based on this approach requires a restrictive context (Allen and Perrault, 1979).

> In restrictive domains, such as the train station, identifying the fundamental goal (i.e. boarding, meeting) is sufficient to identify the subgoals desired. In such settings, very brief fragments can be used successfully.
>
> (Allen and Perrault, 1979, p.56)

However, creating an agent based on a plan based approach is very complex because it requires a dynamic process of detection (Hong and Cho, 2003, Pietquin, 2009). Dynamic detection implies a plan schema and meta-plans (plans regarding a certain plan) (Litman, 1985). The plan schema includes an action schema which consists of preconditions and effects. The preconditions can be described as conditions that must be achieved before applying a speech act and the effects refer to the conditions that become true after implementing the act (Allen and Perrault, 1979, Suchman, 2007, Stent and Bangalore, 2014).

Collaborative or joint action approach

A collaborative or joint activity approach is based on the observation that both parties in a dialogue have responsibilities to sustain and feed the dialogue (Cohen, 1997, Josefa et al, 2006). As opposed to the previous approaches (grammar-based and plan-based) to dialogue modelling, this approach gives emphasis to the importance of clarification and confirmation and the mutual understanding between partners in dialogues (Kshirsagar et al, 2005), which are essential components of human behaviours in interactive dialogues (Cohen, 1997). In joint collaborative activities, the success of the interactions relies on an appropriate coordination between participants' actions (Clark and Schaefer, 1989). Lochbaum (1993) suggests that the dialogue should not be viewed as merely a fixed structure in which a turn is followed by another turn. In interactive dialogue, especially in task-oriented dialogues, we have to consider the sub-dialogue or the segments that happen during the dialogue to ensure a better success for the task (ibid).

> Closer analyses of face to face communication indicate that conversation is not so much an alternating series of action and reactions between individuals as it is a joint action accomplished through participants' continuous engagement in speaking and listening.
>
> (Suchman, 2007, p.87)

Indeed, contributions in dialogues are affected by participants' experience which is a part of the "baggage e.g. prior beliefs, assumptions and other information" that they carry with them (Clark and Schaefer, 1989, p.260). Inside this baggage, there are some common grounds that facilitate the mutual understandings in a dialogue (Stalnaker, 1978 and 2004). Jurafsky and Martin (2009) suggest that confirmation and clarification moves and acknowledging the speakers are seen as parts of the process of establishing the common grounds between interlocutors. This process in turn facilitates the success of the task and performs the accurate actions (Jurafsky and Martin, 2009, Zacarias and De Oliveira, 2012). Table *9* below illustrates types of evidence of understanding proposed by Clark and Schaefer (1989).

No	Type of Evidence	Descriptions
1	Continued attention	B shows she is continuing to attend and therefore remains satisfied with A's presentation.
2	Initiation of the relevant next contribution	B starts in on the next contribution that would be relevant at a level as high as the current one.
3	Acknowledgement	B nods or says *"uh huh," "yeah,"* or the like.
4	Demonstration	B demonstrates all or part of what he has understood A to mean.
5	Display	B displays verbatim all or part of A's presentation

Table 9: Types of Evidence of understanding between participants

(Clark and Schaefer, 1989, p.267)

In addition, a collaborative or joint activity approach requires understanding individuals' motivations behind the interactions (Moller, 2006). Understanding these motivations of participants and their beliefs leads to better identification and specification of the model and its structure. This approach employs different concepts from both grammar and plan based approaches (Moller, 2006, Shi et al, 2010, Pietquin, 2004 and 2009). Based on joint action theories, the prediction of the mechanism between parties in dialogue leads to satisfying and achieving their goals (Dino and Chella, 2013). The goals of participants in a dialogue can be achieved by modelling and combining the mutual intentions in collaborative dialogue (Lochbaum, 1993). However, this approach needs a high degree of natural language processing (Moller, 2006).

It could be said the purpose of the interaction and its complexity play a crucial role in determining a specific approach to modelling dialogue (Cohen, 1997). The process of argumentation is not a rigid and fixed structure because different conversational behaviours may occur. Walton (2006) suggests that the word 'argumentation' refers to the dynamic process which occurs during the interactive dialogue between two individuals. The sequence of moves that controls the flow of the dialogue is shaped and moulded by both parties (Botocrates and the user). Walton (2007) states that:

> Argumentation is seen as a dynamic process in which one party puts forward an argument that may change and develops as it is confronted in a dialog with the question, doubts and criticisms of another parry who may or may not accept the argument.
>
> (Walton, 2007, p.1)

Argumentation is a joint activity where the two parties (Botocrates and the user) should feed and contribute to the development of the argumentation process (Anderiessen and Schwarz, 2009). A joint activity involves a set of behaviours which need to be considered and coordinated (Ahrndt and Albayrak, 2016). The set of behaviours during the interaction between users and Botocrates is represented in their conversational moves (Chen and Jokinen, 2010, Bunt, 2013b). Therefore, the main challenge of designing Botocrates' dialogue strategies and tactics is to take into account different conversational scenarios (Nishida et al, 2014). These scenarios have to be devised to represent the dialogue algorithm that could deal with various communicative moves (Andrews and Quarteroni, 2011).

3.6 Key design principles for creating a conversational agent

The design of a conversational agent that aims to achieve particular tasks when interacting with users passes through different stages. This section explains the design principles needed to be taken into account by the developer during the design of Botocrates. This section is central to the research study since it clarifies the stages covered by the study and the other stages that are beyond the scope of my work. The section justifies the questions and objectives of my research.

Creating a useful and effective interactive computer system is based on three key principles (Gould and Lewis, 1985), which can be seen as a three-stage process (Carey, 1995, Joshi and Sarda, 2010). The three principles are: a) early focus on tasks and users, b) building a simulation and prototype, and c) iterative design (Gould and Lewis, 1985, p.300). The three principles could provide the designer of a conversational agent with valuable guidance that allows her/him to build a conversational system to achieve tasks with as few problems as possible (Jurafsky and Martin, 2009). The rationale for employing the three principles is that these principles help in detecting the flaws of the design in the early stages which could eventually be eliminated (Shaw, 2015). The three principles can guide the developer of a conversational agent to design, test and refine dialogue strategies, tactics and error massages etc. (Jurafsky and Martin, 2009). These principles emphasise the user as a central element and an active member in the process of designing and developing the proposed system (Isaias and Issa, 2014). Such an approach is called a User Centred Design (UCD) or Human Focused/Centred Design (HCD) approach since the reactions of users contribute to modifying and shaping the design of the system (Williams, 2004, Rogers et al, 2011).

> An e-learning system is thoroughly interactive, and therefore, interaction should be its key element in its conception and its design, also taking into account user necessities and characteristics. The user is involved in each stage of the process, and it should be granted that the final product fulfil the

> needs and the characteristics of the user, creating the possibility of positive learning experience.
>
> (Digion and Sosa, 2012, p.39)

Martin and Nieto (2012) suggest that the UCD approach is a useful approach for designing a pedagogical conversational agent so that the design can evolve into a new and better version. For creating a pedagogical conversational agent, the users' opinions and needs should be taken into account in order to reduce the risk of rejecting the final system (Barres, 2012).

Early focus on tasks and users

At the early stage of creating a system, the designer needs to focus on understanding the nature of the tasks and potential users' behaviours (Gould and Lewis, 1985). The interaction between potential users and Botocrates is seen as task-oriented as both users and Botocrates aim at accomplishing particular goals (Pietquin, 2004) and, therefore, these tasks must be identified at the early stage of building the actual system (Wang and Nakatsu, 2013). The developer of a pedagogical conversational agent is required to define, at the first stage, what the system can offer (establishing the purpose of the design), and more importantly, how to achieve the final goal (Kerly et al, 2010). Answering such questions has substantial implications on designing the dialogue strategies, such as who controls the flow of the dialogue, how the path of the dialogue can be planned and structured and how to handle unexpected responses (ibid). Jurafsky and Martin (2009) suggest that at this stage the designer should be aware of the investigations being made in similar studies and the theories of human to human dialogues (Chapter 2 & Chapter 3 present the foundation theories and similar studies related to my work).

During the first stage, the developer of the system needs to have close contact with the context of the study including users and tasks (Dautenhahn and Saunders, 2011). In order to understand the tasks and users' conversational behaviours, there is a need for corpora that illustrate the process of interaction (Mazzotta et al, 2007, Novielli and Strapparava, 2011). One of the main resources for creating conversational agents is recording and gathering transcripts from natural interactions that occur within the specific context (Moller, 2006, Rossen et al. 2009). Domain specific corpora help in determining the features and the characteristics of the system (Stavropoulou et al, 2011). In-domain dialogue logs provide the designer with the content of the dialogue and the interactional behaviours of potential users (Lemon and Pietquin, 2012). The availability of such a corpus enables the designer to establish the dialogue structure (Esposito, 2005). For example, if the designer wants to create a conversational agent that performs the tasks of the receptionist in the School of Education at the University of Leeds, the first step is to record the dialogues occurring between the receptionist and different students. The analysis of the logs can reveal the tasks that should be performed and provide a better understanding of students' conversational behaviours (Evers and Nijholt, 2003, Rieser and Lemon, 2011). The availability of domain specific language data gathered from Human to Human Interaction is essential in the early stage of designing a dialogue system because it can inform the design and serve as training data for conversational system components (Minker, 2010, Lee et al, 2015).

Here, I would like to explain the challenges facing Botocrates at this stage. Botocrates aims to build his own dialogue strategies from scratch. Such a situation leaves Botocrates with a 'chicken and egg' problem. The 'chicken and egg' problem or 'who comes first' situation requires Botocrates to establish initial scenarios, predict users' conversational behaviours, and imagine the best design of dialogue strategies (Rayner, 2000).

> In order to develop the system capabilities, one needs to have a large corpus of data for system development, training and evaluation. In order to collect data that reflect actual usage, one needs to have a system that users can speak with.
>
> (Benesty et al, p.712)

Rieser and Lemon (2011) suggest that building a conversational agent from scratch is challenging since the designer has to find out what best dialogue strategies can achieve the tasks and then test the initial design in a simulated environment.

Building a simulation and prototype

The second stage in the process of the design is building a simulation and prototype that could reflect and implement the actual work (Gould and Lewis, 1985). Building an initial prototype of the proposed system allows the designer to test out and improve the early design by recording and analysing the performance of the system and users' reactions (ibid). Building a prototype (either in part or the entire working model of the proposed system) could increase the possibility of producing a system that could meet users' needs (Blackham et al, 2012, Preece, et al. 2015). The rationale for creating a simulation and prototype is to enable the designer to test the designed architecture experimentally without the need to design the entire system (Jurafsky and Martin, 2009, Baxter et al, 2015). The observations of the potential users when interacting with the prototype can help in spotting any flaws and shortcomings in the early stages (Melichar and Cenek, 2006). By the use of interactive simulation, the conversational modelling can be modified to include any users' interactional behaviours that were not considered in the early work (North and Macal, 2007). Dautenhahn and Saunders (2011) argue that the aim of the second stage of designing a human robot interaction is to investigate how users interact with the new system. During the first stage of design, the developer carries out an analytical investigation (what should go into Botocrates' brain), whilst the second stage requires an empirical investigation (how users interact with Botocrates) (Gould and Lewis, 1985).

Creating an interactive simulation could enable the developer to test the usability of the proposed system (Gould and Lewis, 1985, North and Macal, 2007, Jurafsky and Martin, 2009, Baxter et al, 2015). The usability of the system broadly refers to the extent to which the system can be utilized to accomplish particular goals effectively and efficiently (Nielsen, 1994). Evaluating the usability and functionality is essential in the early stage of the process of developing a conversational agent (Foster, 2007, Kurkovsky, 2009, Crockett et al, 2011, Nishida et al, 2014). It could be claimed that evaluating system usability is more powerful if integrated in the iterative design process (Rubin, 1994, Paas and Firssova, 2004). Meena and Sivakumar (2014) argue that the main motive of usability evaluation is to increase both the efficiency and the productivity of the system (task performance) and to foster users' satisfaction. The usability evaluation is based on real use observations when users interact with the prototype (Williams, 2004). Analysing the logs extracted from the interaction between users and the system can reveal whether the designed strategies during the dialogue process successfully achieve the desired goals or not (Hung et al, 2009, Gulz et al, 2011). Furthermore, examining users' perspectives after interacting with the simulation could enable the designer to discover users' levels of satisfaction which in turn help in refining the initial version (Andrews and Quartenroni 2011, Sagae et al, 2011).

The WOZ simulation (a human plays the roles of the system) is widely used for testing prototypes of conversational systems under design (Petrie et al, 2002, Kerly et al, 2006, Dybkjær et al, 2007, Bradley et al, 2008, Jurafsky and Martin, 2009, Webb et al, 2010, Perez-Marin, 2011, Lopez-Cozar et al, 2011, Nishida, 2012, Mencia et al, 2013). As the WOZ technique is adopted in my research study, the explanation and the justification of employing this technique are fully clarified and explored in chapter 4, section *The Wizard of Oz*.

Iterative design

Iterative design refers to the repeated cycle of evaluation and refinement conducted by the developer, until the final version of the prototype or proposed system is produced (Abrahamsson et al, 2006, Dautenhahn and Saunders, 2011). The main purpose of the iterative process of development is to allow the designer to deal with any shortcomings and fix them between the cycles of iteration (Kurosu, 2016). Therefore, iterative design can be seen as a dynamic process of improvement (Gay and Hembrooke, 2004).

> When problems are found in user testing, as they will be, they must be fixed. This means design must be iterative. There must be a cycle of design, test and measure, and redesign, repeated as often as necessary.

(Gould and Lewis, 1985, p.300)

Iterative design is highly recommended and applied in the field of HCI (Campos et al, 2011). Because of the complexity of users' conversational behaviours when interacting with Botocrates, it is almost impossible to design the final working system without applying an iterative development approach (Ghaoui, 2005). Instead, "the road to success in interaction design is to fail early and often" (Ballagas, 2008, p.1). Therefore, the iterative design cycle enables the developer of a conversational agent to redesign the system to avoid any existing flaws so that a more capable system can emerge (Jurafsky and Martin, 2009). Several studies confirm the substantial advantages of applying iterative design in the process of creating a conversational agent (Cassell, 2000, Jurafsky and Martin, 2009, Gulz et al, 2011, Suthers et al, 2013, Brinkman et al, 2015).

The final dialogue system is designed based on the characteristics and the features of the final prototype (Moller, 2006, Wahlster, 2006, Jurafsky and Martin, 2009, Minker, 2010). However, it is difficult to predict when the final prototype can emerge. Such iterative processes last until all of the limitations of the design are identified and addressed (Sears and Jacko, 2009). Modifying the design is a continuous process until the desired outcomes and usability goals are obtained (Galitz, 2007). The final prototype is attained when the design meets the requirements and has achieved the desired functionality (Jacko and Stephanidis 2003, Wang, 2013).

3.7 Conclusion

At the starting point for creating a conversational agent, there is a need to identify what the agent (Botocrates) can offer to users and how it can be offered. At this stage the developer must have close contact with the target context. By carrying out such investigation, the designer aims to find out what tasks are needed to be performed and how they can be effectively accomplished during the interaction. The dialogue processes between the agent and users have to be controlled and managed in order to achieve the final goals of interaction. During this analytical investigation, the developer should establish the structure and the process of the information exchange. As the main aim of Botocrates is to promote users' critical thinking and academic argumentation skills, the overall framework of an exchange structure has to contribute to accomplishing the ultimate goal of the design. Botocrates' interaction with a user is classified as a mixed-initiative dialogue, since each party can lead the flow of the interaction. Therefore, the basic units of interaction (turns) and adjacency pairs should be coherent and related. Engaging users in the argumentation process involves a better preparation and organization of the consecutive expansion of adjacency pairs. Defining the conversational moves that could reflect the nature and the goal of the interaction is essential at the early stage of the design. It allows for a better classification and interpretation of users' inputs, which in turn can lead to successful implementation of the next actions performed by the agent.

By the end of the first stage of designing a conversational agent (the analytical stage), the designer should be able to build a simulation and initial prototype that could reflect the interaction between the users and the agent. Modelling an initial version of Botocrates enables the designer to detect any flaws and shortcomings by experimentally testing the initial prototype with users. Implementing the interactive simulation helps in testing the usability and the functionality of the proposed system. The rationale of usability evaluation is to ensure the tasks' completion and to increase users' levels of satisfaction. Following the initial experiments, the design could be subjected to a repeated cycle of iterative development until the desired outcomes are achieved. When the final prototype emerges, it can be integrated in the components of the system.

At this point, I would like to clarify what stages will be covered within the scope of my research study. As shown in Figure *13*, my study starts by conducting an analytical investigation covering the first stage: early focus on tasks and users. The main aim of the first stage is to find out "what should go into Botocrates' 'brain' that is likely to promote critical thinking and academic argumentation skills?" The first stage will be followed by the design of an initial prototype that could reflect the goal of the design. By using the WOZ simulation technique in the second stage, the prototype will be evaluated and tested with real users. At this stage, the study aims at investigating what happens when learners interact with Botocrates. However, because of the nature of the study and timescale available for conducting my PhD research (Denscombe, 2014, Ryan, 2013, Newby, 2014, Newing, 2010), the prototyping process will continue for as long as the timescale within a PhD study allows. Note that, the descriptions and the justifications of each stage of the research study is extensively explained in the following chapter, chapter 4 *Methodology*.

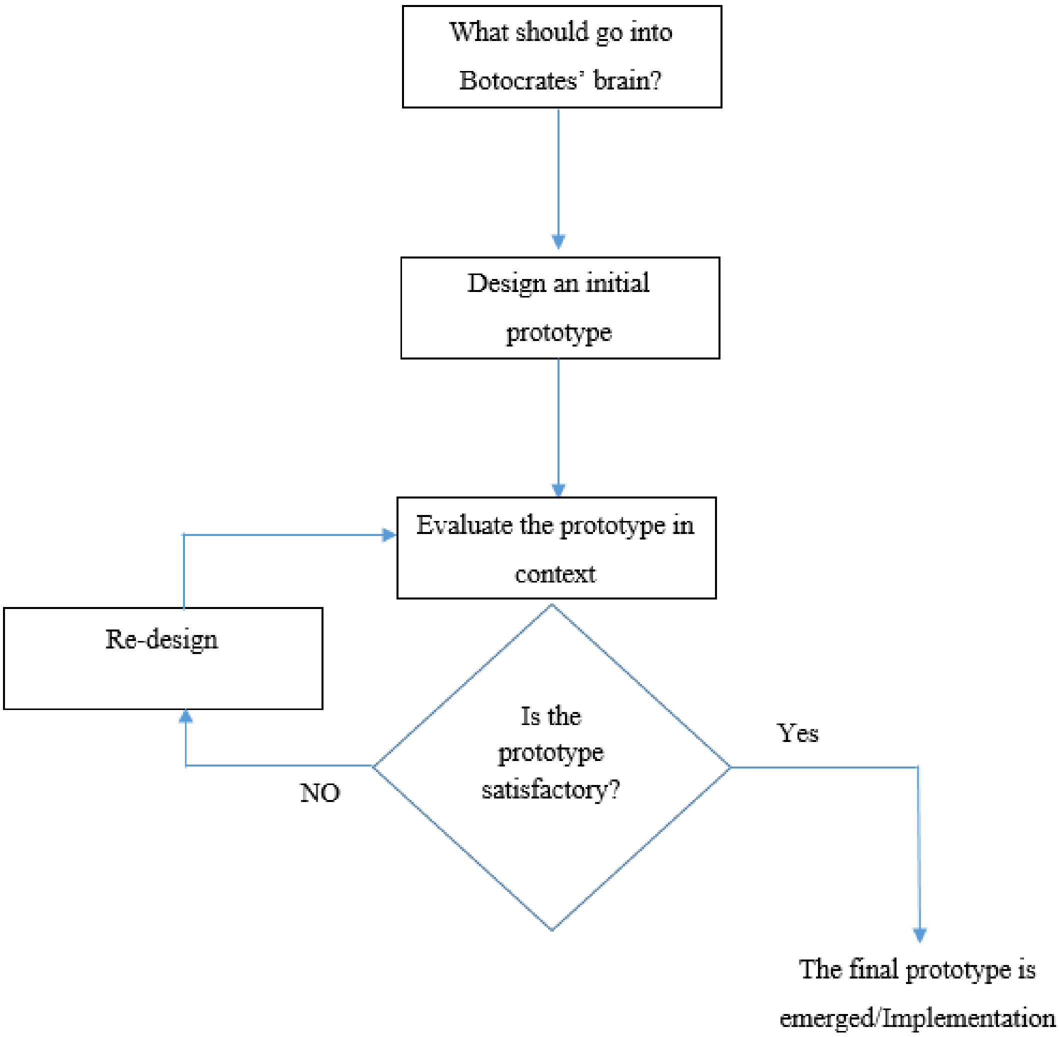


Figure 13: Cycle iterative design process adopted in my research study

(Alavi and Umanath, 1989 & Dix et al, 2004)

Chapter Four: Methodology

4.1 Introduction

The aim of this chapter is to give an overview and outline of the research methodology adopted for conducting the study. The term methodology is defined as the scientific methods and approaches used for obtaining the final goal of the research (Mouton and Marais, 1988, Singh, 2008). This chapter includes identifying, describing and defending the chosen research design and its methods.

This chapter consists of seven sections which aim at providing readers with a detailed description of why and how the methodological approach, procedures and instruments were employed for building and evaluating Botocrates' prototype. The second section, following this section, identifies the research objectives and questions. The third section aims at introducing the research site, where the research study took place, and the students who participated in the research. The fourth section defends and justifies the adoption of a qualitative exploratory study for carrying out the research. The fifth section explains the procedures and instruments implemented for conducting my research. This section is further divided into two subsections which illustrate the procedures and the chosen instruments according to the two stages of the implementation of the study: a) building Botocrates' prototype, and b) the evaluation of Botocrates' prototype. The sixth section is concerned with the issues related to the quality of the research. Finally, the seventh section illustrates the ethical considerations that were taken into account during the process of carrying out this research study.

4.2 Research Objectives & Questions

The fundamental aim of the study is to design and evaluate a prototype of a conversational agent (Botocrates) that could promote critical thinking and academic argumentation skills. Designing and evaluating the prototype can give us a better understanding of whether a conversational agent can be used for supporting critical thinking and academic argumentation skills or not, and if so, how? Therefore, the overarching research questions are:

- Can a conversational agent (Botocrates) support critical thinking and academic argumentation skills? If so, how?

Taking into account the overarching aim, the design and execution of the research study is carried out in two stages and each stage has its own objectives and sub-questions that aim at contributing to the final goal of the study. *Table 10* shows the overarching research questions and the sub-questions according to each stage of the implementation of my research study.

The Overarching research questions	
Can a conversational agent (Botocrates) support critical thinking and academic argumentation skills? If so, how?	
Stage one : Modelling Botocrates' prototype	
Main question	What should go into the agent's 'brain' that is likely to promote critical thinking and academic argumentation skills?
Sub-question 1	What are the tasks and sub-tasks needed to be performed by Botocrates when conversing with users?
Sub-question 2	What are the dialogue strategies and tactics of Botocrates that could help in achieving the final goal of interaction?
Sub-question 3	How can Botocrates' domain of knowledge support the implementation of Botocrates' intellectual conversational behaviours?
Stage Two : The evaluation of Botocrates' prototype	
Main question	What happens when learners interact with Botocrates?
Sub-question 1	Does Botocrates succeed in performing the tasks of interaction including users' engagement in the argumentation process? If so, how?
Sub-question 2	How do students feel when chatting with Botocrates?

Table 10: The overarching research questions & the sub-questions of the research study

The sub-questions of each phase of carrying out the study were designed to address the central research questions. These sub-questions are directly linked to the research objectives to meet and accomplish the main purpose of the study. The next subsections illustrate the objectives and the sub-questions of each phase.

Stage one: Modelling Botocrates' prototype

The purpose of this stage is to model the Botocrates' prototype for the purpose of supporting students' critical thinking and academic argumentation skills. The study in this stage identifies three specific objectives, which are:

- To investigate the tasks and sub-tasks needed to be performed by Botocrates when conversing with users. The type of dialogue occurring between Botocrates and user can be described as a task-oriented dialogue since Botocrates and users have final goals needed to be achieved (Pietquin, 2004, Wolska and Buckley, 2008). With such an agent the tasks should be well-defined in the early stage of the design (Rickel and Johnson, 2000, Wang and Nakatsu, 2013).

- To explore what the dialogue strategies and tactics of Botocrates are required for achieving the final goal of interaction. The tasks and sub-tasks of Botocrates can be performed by the execution of particular strategic conversational manoeuvres during the interaction with users (Walton, 1998, Zarefsky, 2014). The tactics of the dialogue refer to the purposeful moves employed to achieve the short-term goal of interaction, and dialogue strategies refer to the long-term goal of interaction (Sottilare et al, 2014).
- To investigate how the specific-subject domain of knowledge can facilitate the process of dialogue so that the generation and the development of the argumentation process and reflective thinking can be achieved.

In order to achieve these objectives, the study was designed to seek the answers to one central question and three related sub-questions:

A) What should go into the agent's 'brain' that is likely to promote critical thinking and academic argumentation skills?

A-1) What are the tasks and sub-tasks needed to be performed by Botocrates when conversing with users?

A-2) What are the dialogue strategies and tactics of Botocrates that could help in achieving the final goal of interaction?

A-3) How can Botocrates' domain of knowledge support the implementation of Botocrates' intellectual conversational behaviours?

Stage Two: The evaluation of Botocrates' prototype

The aim of this stage is to evaluate the effectiveness of the Botocrates' prototype from the two different angles: a) the evaluation of the outcomes of the chats between Botocrates and users, and b) the evaluation of Botocrates' performance from users' perspectives. Therefore, the three specific objectives of this stage are:

- To examine to what extent Botocrates is efficient in performing the tasks including the main goal of interaction, which is users' engagement in the argumentation process. One of the main aspects of evaluating conversational agents is evaluating the performance in terms of whether the agent has achieved the purpose of the design or not (Foster, 2007, Crockett et al, 2011, Nishida et al, 2014)

- To explore users' feelings and satisfactions about the interactions with Botocrates. This in turn helps to evaluate Botocrates from users' perspectives which is a very important element in the process of evaluation (Abu Shawar and Atwell, 2007a, Quarteroni and Manandhar, 2007, Hastie, 2012)

The study in the evaluation stage aims at discovering the answers to one key question and two linked sub-questions:

B) What happens when learners interact with Botocrates?

B-1) Does Botocrates succeed in performing the tasks of interactions including users' engagement in the argumentation process? If so, how?

B-2) How do students feel when chatting with Botocrates?

4.3 Research Site & Participants

The descriptions of the selected location, where the research takes place, and the participants, who contribute to the input of the collected data, have to be carefully addressed (Miles et al, 2013). The determination of the appropriate site and participants for conducting the research is considered as one of the most important issues that should be taken into account (Kervin, 2006). Deciding where the research will take place should be based on the goal of providing rich and comprehensive relevant data that would lead to a better understanding of the matter being investigated (Miles and Huberman, 1994). Since the research aims at promoting students' critical thinking and academic argumentation skills, the selection of the context and its settings is a very significant issue in achieving the goal of inquiry. Yin (2011) suggests that a qualitative researcher should choose the research site that is compatible with the study being investigated in order to get the best relevant data.

The two stages of the research study (building and evaluating Botocrates' prototype) have been conducted in the School of Education at the University of Leeds, where the MA ICT/ELT in Education course is taught online. The course is designed to cover a wide range of issues relating to the use of technology in supporting the learning process across a variety of educational settings and pedagogical interactions. The programme is intended to enable students to gain practical experience of the design and the evaluation of learning materials in e-learning environments. Students who enrolled in the programme used a virtual learning environment (VLE) to work together cooperatively and collaboratively. The use of the VLE and the University Portal allow students to have access to learning resources including module materials and the electronic library of the University of Leeds at anytime from anywhere. My study selected the module *Language Learning & Teaching with ICT* to gather and analyse materials for supplying Botocrates' brain. The choice of the module was based on the number of registered students to ensure there were a sufficient number of participants who could produce enough data (the descriptions and the justifications of sampling techniques and data collection are explained in further detail in section *4.5 Collection and analysis of data).*

The selected module is designed to address both theory and practice for the purpose of supporting language learning and teaching with ICT and it aims at providing MA students with opportunities to explore and examine information technologies and approaches that could be adopted for this purpose. The module is taught using both synchronous and asynchronous on-line communications. To gather the data for building Botocrates' prototype, the logs of the synchronous online chats, which occur each week during the semester, were collected. The synchronous online chat is text-based and it is based on academic publications and research papers related to the weekly topics. The online seminars take place in the Adobe Connect platform provided within the VLE. The seminars are facilitated by the module tutors who give opportunities to the students to take some responsibilities for leading their discussions. The two given responsibilities are: a) managing the chats during the sessions, and b) taking notes and then posting them after the sessions on the discussion boards which are provided within the VLE. The main role of the chat managers is to make sure that the list of questions, previously prepared by tutors designed to be discussed during the chats, will be covered during the sessions. Both distance learners, who are not resident in Leeds, and Leeds-based learners enrolled in the module are required to attend the synchronous online chats. The module combines full-time students and part-time students. The majority of the students registered in the module were international students (20 students), who speak English as a second language.

As illustrated in the introductory chapter, section *1.4 The starting point of the study*, the idea of conducting my research in the area of critical thinking and academic argumentation stems from my successful experiences during studying the same module in the School of Education at the University of Leeds. It could be said that understanding the context of the research can be seen as an essential element that the researcher should be equipped with. The lack of knowledge about a specific context may lead the researcher to risk misunderstanding participants' actions and views, and the meaning of the particular event being investigated

(Ritchie and Lewis, 2003, Maxwell, 2012). When doing qualitative research, immersion in the settings and familiarity with the context helps the researcher in getting a better understanding and interpretation of the research findings (Miller and Dingwall, 1997, Holloway and Wheeler, 2013). The advantage of being familiar with the context enables the researcher to get detailed descriptions and allow her/him to go beyond surface interpretations to uncover their participants' perspectives and feelings (Holloway and Wheeler, 2013).

> Meaning in qualitative data is contextually dependent. In other words, how one interprets particular utterances in an interview, say, depends on the context within which that utterance is made.
>
> (Fielding et al, 1998, p.57)

However, the researcher in any qualitative research has to ensure better interpretation of the collected data in order not to be at risk of subjective analysis of the research findings (McLeod, 2008, Silverman, 2010, Cohen et al, 2013). Later in this chapter, section *4.6 The quality of the study*, this issue is explored in further detail.

4.4 Research design

The research design section aims at describing the entire process and procedures of conducting the research and, in particular, how these steps would enable the researcher to find out the answers to the research questions based on best relevant evidence (De vaus et al, 2001, Boeije, 2009, Harwell, 2011). The clarification of the overall plan and the structure of the research design should be well articulated and supported in order to be trustworthy and reliable (Van Den et al, 2006, Vogt et al, 2012, Rovai et al, 2013). This section presents the research design of my research that includes: a) the classification of my research study and the justification for this classification, b) the procedures and instruments used for collecting and analysing data during each phase of the study. The description of the adopted procedures and instruments is accompanied by the rationales for choosing these instruments to be the most suitable options for addressing the research questions.

There are different ways to classify any educational research. For example, the classification can be based on the purpose of the research or on the research methods used for conducting the study (Ross, 2005, Pathak, 2008, Khan, 2008).Considering both the nature of investigation of my study and the methods used, my research could be classified as a qualitative exploratory research study. The proposed classification is defended and justified in the following sections.

The exploratory purpose of the study

The purpose of this research is exploratory, as using a conversational agent for enhancing CT and academic argumentation skills seems to be a new area of investigation. Despite the fact that conversational agents and chatbots have been used in different domains and contexts (Kerly and Bull, 2006, Quarteroni and Manandhar, 2007, Abu Shawar and Atwell, 2007a, Zakos and Capper, 2008, O'Shea et al, 2010, Augello et al, 2012, Kuligowska, 2015), employing conversational agents for the purpose of promoting academic argumentation skills can be described as a little-known educational practice. Exploratory studies can be employed when the field of study lacks prior research or previous studies, which might help in establishing the starting point of further studies (Ross, 2005, Duff, 2012, Fitzpatrick and Kazer, 2011, Schwab, 2013). Gordon (2014) suggests that the exploratory research in educational settings tries to investigate a new issue that is not fully explored and understood amongst educators. My research could establish the baseline for a new intervention for promoting CT skills. The research highlights the need for considering a new area and concept, previously not explored in adequate detail, possibly leading to better practice in teaching and learning (Ross, 2005, Fitzpatrick and Kazer, 2011).

Designing and evaluating such a novel intervention could be derived from conducting exploratory studies (Wegerif, 2007). The exploratory research aims at seeking the answer to what is happening when implementing a new intervention (Robson, 2002, Gray, 2013). Thomas (1998) argues that studies can be described as an exploratory investigation when the researcher is not guided by particular hypotheses or specific questions, but only by very general questions. For example, can a conversational agent support critical thinking and argumentation skills? If so, how? Another rationale for doing exploratory study is the need to focus on how Botocrates could achieve the main goal of interaction which has not yet been illustrated and described in any great detail (Fitzpatrick and Kazer, 2011).

The exploratory research is seen as data-driven (Mellenbergh, 2008, Plonsky, 2015) and a bottom-up or theory generating approach (Carr et al, 2004, Johnson and Christensen, 2010). My study is based on studying and examining a large corpus that was gathered from online chats to generate ideas, dialogue strategies and theories to be adopted by Botocrates. Adopting a data-driven and exploratory study approach for building and evaluating Botocrates' prototype gives me the flexibility needed, especially when interesting findings appear and when new insights arise (Saunders et al, 2009, Plonsky, 2015). It can be said that the nature of the inquiry of my research is inductive reasoning because it includes (1) systemically examining and analysing the logs of students' online text-based chats, (2) attempts to discover patterns or themes of argumentations and exploratory talks, (3) building and developing the intervention (Botocrates) from the findings and the analysis of the transcripts of students' online seminars (Lodico et al, 2010). The inductive approach is suitable for my research because the area of investigation is novel and it is not preceded by prior studies (Rose et al, 2014). Given (2008) claims that inductive reasoning is essential for a qualitative research approach, especially when empirical data is used to expand our understating of a new setting.

Why a qualitative research study?

Qualitative research refers to any research that does not rely on the use of numbers and statistics to study a certain phenomenon (Strauss and Corbin, 1998, Miles et al, 2013). Instead, the nature of investigation in qualitative research focuses on understanding the issue being investigated in its natural settings (Hatch, 2010). This approach pays more attention to the meanings of participants' experiences and actions in their contexts and the real world using a variety of methods such as discourse analysis and interviews (Clarke, 2000, Fortune et al, 2013). One of the main reasons that encouraged me to choose a qualitative approach is the nature of my research (Strauss and Corbin, 1998). Marshall and Rossman (2015) suggest that adopting qualitative research is justified when the research questions are best answered and addressed in their real-world and natural settings with all their complexities. The questions of my study attempt to answer 'what should go into the agent's 'brain' that is likely to promote students' CT and academic argumentations skills?' and 'What happens when students interact with the chatbot?' Answering such questions requires using qualitative methods because these methods, in particular, allow the experiences and complexity of programmes to be explored and understood in-depth (Simons, 2009, Houser, 2014).

By carrying out qualitative research, my research aims at gaining deep insights and a rich understanding of the issue under investigation (Saunders et al, 2009, Lichtman, 2010). One of the aims of my research is to gain a deep understanding of how the process of argumentation could be established and developed within a specific domain. Building Botocrates' prototype requires deep insights of how the process of argumentation started and was implemented. CT and academic argumentation skills are not only general skills, they are also subject-specific domain skills which have to be taken into account (Lipman, 1988, Bailin et al, 1999, Davies, 2004, Willingham, 2007, Bulter, 2015). Andrews (2010) argues that each specific subject has its own unique way of constructing, analysing and evaluating arguments. In addition, employing qualitative methods such as interviews allow me to gain an in-depth exploration of students' satisfaction and attitudes when conversing with the conversational agent. The perspective of students is very important to understand their behaviours towards Botocrates (Sherman and Webb, 2004). We consider doing qualitative research when there is a need to study participants' perspectives and points of view about a particular life experience within their personal circumstances (Spencer et al, 2003, Yin, 2015).

However, there are some limitations in adopting qualitative research, such as it usually relies on small numbers of participants compared to quantitative research, which could lead to questionable validity and uncertain generalisations (Yin 2003, Breakwell, 2008, Willig, 2013, Jolley, 2013). Because of employing a small number of participants, qualitative research tends to follow more purposive sampling strategies rather than random or probability sampling, which can limit the generalization (Patton 1990, Patton, 2014, Bryman, 2012, Erford, 2014). Another reported weakness of qualitative approach is that the interpretations of the research findings can be influenced by the subjective feelings of the researcher (Rowley, 2002, Silverman, 2010, Cohen et al, 2013). In the light of the previous argument, it could be said that the central aim of doing qualitative research is not the need for generalization but rather the aim is to get a rich and deep insight into the phenomena under investigation (Blaikie, 2009, Thomas, 2010, Stake, 2010). Although the subjectivity of the researcher, in understanding and interpreting the findings, might be an unavoidable part of qualitative research, it should not be depicted as a problem but instead it can be properly checked and observed (Simons, 2009). Rather than denying being subjective in the evaluation and judgment of the research results, in qualitative research there is a need to focus on reflexivity to track any feelings and biases that could affect the line of inquiry (Hatch, 2010, Holloway and Brown, 2012). This issue is explained in further detail in section *4.6 The quality of the study*.

4.5 Collection and analysis of data

This section covers issues related to the methods and procedures of data collection and analysis. The section is divided into two main subsections according to the two phases of conducting the research study: a) modelling Botocrates' prototype, and b) evaluation of Botocrates' prototype. The two main subsections are, in turn, divided into three parts that offer not only detailed descriptions of the process of sampling, data collection, and data analysis, but also include the justifications for any decisions made during these processes.

4.5.1 Phase one: Modelling Botocrates' prototype

The purpose of this phase of the study is to gather and analyse materials for building the brain of Botocrates. At an early stage of the design, it is very important to determine: a) the tasks and sub-tasks needed to be performed by Botocrates (Pietquin, 2004, Wolska and Buckley, 2008, Rickel and Johnson, 2000, Wang and Nakatsu, 2013), and b) the dialogue strategies and tactics that control the flo The overarching research questions were: can a conversational agent support critical thinking and academic argumentation skills? If so, how?

w of the dialogue for achieving the final goal of interaction (Abraham et al, 2007, Huang et al, 2007, Friedenberg, 2010, Woudenberg, 2014). As the central goal of Botocrates is to promote CT and academic argumentation skills, this phase of the study is designed also to discover the ideal dialogue process and tactics that should be adopted by Botocrates in order to achieve the final goal. The purpose of this section is to clarify and justify the methods and the processes of data collection and analysis used during the stage of modelling Botocrates' prototype.

Sampling

While a sample refers to a part of a population or a portion of a group, sampling is defined as the process of choosing a specific portion from the entire population (Khan, 2011, Daniel and Sam, 2011, Polit and Beck, 2013). In order to increase the validity and trustworthiness of any research, the sampling process must be clearly defined and carefully conducted (Singh and Bajpai 2008, Boswell and Cannon, 2014). It could be claimed that the researcher in a qualitative study tends to select the units of data based on a particular purpose (Patton 1990, Rubin, A. 2009, Creswell, 2012a, Patton, 2014). In contrast to probability sampling strategies where the units of data are selected randomly, purposive or purposeful sampling techniques rely mainly on selecting "rich units of data" (Patton, 1990, p.169). Purposive sampling is seen as a valuable technique in an exploratory study as the researcher aims at exploring the phenomena being investigated in more depth (Adler and Clark, 2007). Merriam and Tisdell (2015) state that "purposeful sampling is based on the assumption that the investigator wants to discover, understand, and gain insight and therefore must select a sample from which the most can be learned" (p.96).

The selection of the module *Language Learning & Teaching with ICT* was based on the number of enrolled students. 22 students were enrolled in the module, the largest number to be enrolled in any module during semester one in the MA ICT/ELT in Education course. The study deliberately selected a large number of enrolled students because more students that participated in the online chats would result in more turns (Markman, 2013). In conversation, a turn can be defined as a contribution that begins and ends by a particular speaker (sack et al, 1974). Among the objectives of this stage is to explore the process of exchange development and turn-taking mechanisms in order to design Botocrates' dialogue processes. One of the main considerations of the researcher when choosing the site for carrying out a qualitative research is to be able to have access to plentiful and pertinent data (Fox and Bayat, 2008, Yin, 2009), so that the gathered data could give a precise understanding of the matter being investigated (Newing, 2010, Merriam and Tisdell, 2015).

After gathering the transcripts of the online seminars of the module, further consideration was given to determining the data of the analysis. Among these concerns were the justification of choosing particular logs from the entire online chats' records, and deciding the numbers of online logs that should be analysed. According to Yin (2011) there are two challenges facing sampling processes in a qualitative research, which are: a) the need to decide which particular units of the entire data are better to be selected and why, and b) the justification of the sample size employed in the research. The schedule of the module contains 12 units that last for 12 weeks. During the semester, the synchronous online seminars took place each week at different times, afternoons and evenings. According to students' preferences, they have the choice of whether to attend afternoon or evening sessions. Based on the number of students attending online seminars, the tutors divided students into a smaller sub-groups and each sub-group had its own chatroom. *Table 11* below illustrates all transcripts that were collected from the module.

Unit	Number of logs/groups & participants				Status of Records
	Afternoon	Number of participants	Evening	Number of participants	
Unit1/Week1	1	7	3	15	Well-recorded
Unit2/Week2	2	10	2	11	Well-recorded
Unit3/Week3	2	9	2	13	Well-recorded
Unit4/Week4	2	10	2	12	Well-recorded
Unit5/Week5	2	9	3	12	Well-recorded
Unit6/Week6	1	5	3	13	Well-recorded
Unit7/Week7	2	12	2	10	Well-recorded
Unit8/Week8	1	6	0	0	Some session were not recoded Due to technical issues
Unit9/Week9	2	10	2	12	Well-recorded
Unit10/Week10	1	9	1	11	Well-recorded
Unit11/Week11	2	11	2	11	Well-recorded
Unit12/Week12	1	11	1	5	Well-recorded

Table 11: Total number of transcripts collected from the module.

When determining the data for analysis, the research avoided the use of the logs that belonged to the first and the last units. The rationale for avoiding the first weeks of the module was due to the fact that some students might have been unfamiliar with using online text-based chats and that could have affected their contributions and engagements in the online seminars. Salmon (2000) suggests that when beginning the use of an online environment, some participants may experience some difficulties adopting new modes of communication. Other reasons for not choosing online chats of the first weeks and the last weeks were the topics of the discussions. While the topics of first week were designed to introduce online learning, the final weeks were intended to cover some issues related to students' assignments. The study also excluded the online chats' records that were badly-recorded as happened with unit 8 (see Table 11). Purposive sampling in a qualitative research intentionally selects specific units because of their specific characteristics (Arboleda, 2003, Johnson and Christensen, 2013). The central aims of adopting this sampling technique when selecting certain logs from the entire online chats' transcripts is to get the logs that could offer the richest and most thorough information so that the goal of the research can be achieved and the research questions can be answered (Bryman, 2012, Holloway and Wheeler, 2013, Yin, 2015).

It is claimed that the sample size in a qualitative research is not identified before commencing the research (Burns and Grove, 2010, Kumar, 2014, Houser, 2013), and the analysed data can be relatively small compared to a quantitative research (Sowell, 2001, Hays and Singh, 2012). Instead of focusing on the quantity of the data for the purpose of generalization, the quality or the richness of the data is considered the main concern when conducting a qualitative study (Patton 1990, Patton, 2014, Tuckett, 2004, Bloomberg and Volpe, 2012). For the determination of the sample size of the first stage, modelling Botocrates' prototype, the study considered two factors. First, the time scale for carrying out the study (Denscombe, 2014, Ryan, 2013, Newby, 2014). Considering, the practical challenges facing conducting such a research that includes discourse analysis (Newing, 2010). Discourse analysis can be described as a time consuming task, and therefore, the time available to the research should be considered when doing the research (Wood and Kroger, 2000, Markee, 2000, Bowles and Seedhouse, 2007). Patton (1990) states that,

> Sample size depends on what you want to know, the purpose of the inquiry, what's at stake, what will be useful, what will have credibility, and what can be done with available time and resources.
>
> (Patton, 1990, p.184)

The second factor that was taken into account for determining the sample size is reaching the point of 'saturation'. The point of 'saturation' indicates the point of analysis where no new findings appear to be emerging (Robson, 2002, Davies and Hughes, 2014). The point of saturation or redundancy can be identified by continuous comparison of data (Goulding, 2002, Tuckett, 2004). However, researchers could inadvertently claim they reached the saturation point when not obtaining adequate supporting evidence because of the small sample size (Vogt et al, 2014). In order to avoid this problem, the study initially analysed 9 logs, containing 1813 turns, followed by the analysis of an additional 4 logs to ensure reaching the saturation point. As *Table 12* below shows, the total logs analysed at the phase of building Botocrates' brain was 13, which consisted of 2617 turns.

Units	Logs/Groups	Turns	Total Turns
Unit 4	Afternoon group 1	213	817
	Afternoon group 2	190	
	Evening group 1	208	
	Evening group 2	206	
Unit 5	Afternoon group 1	217	996
	Afternoon group 2	213	
	Evening group 1	279	
	Evening group 2	112	
	Evening group 3	175	
Unit 6	Afternoon group 1	252	804
	Evening group 1	153	
	Evening group 2	140	
	Evening group 3	259	
Total	13	2617	

Table 12: The sample size used during the first stage of the study.

Data Collection

Text-based chat data

The source of the data at this phase of the research was the transcripts of synchronous text-based online chats collected from the module *Language Learning & Teaching with ICT*. The transcripts were analysed in order to uncover the characteristics of Botocrates' prototype that could promote critical thinking and academic argumentation skills. Creating a conversational agent that aims at performing particular tasks, requires understanding the process of interactions (Dale, 2003, Kim, 2010, Guida and Tesso, 2014). The conversational agent (the wizard at this stage of the design) should be able to recognise the differences between different expressions and intentions produced by users (Mancini, 2008, Neustein, 2013). From computational linguistics, the study of natural language corpora of dialogues such as the logs of students' online seminars can be useful as a rich source of data for identifying argument patterns and schemes and the whole structure of the dialogue (Gelbukh, 2012, Cabrio et al, 2013). The study of natural language interactions between people has both theoretical and practical benefits related to the design of conversational agents (Grishman, 1986). While the theoretical interests of studying dialogue focus on uncovering the pragmatic constraints of utterances, the practical interests pay attention to the practical issues of producing replies or responses according to users' inputs, e.g. how users' inputs are classified and processed.

One of the rationales of choosing text-based chats to be examined is that chatting with Botocrates is mainly based on text-based interactions. The use of text-based chats could provide a better understanding of the systematic organization of interaction in this mode of communication including the development of exchange structure and turn-taking. Each mode of communication has its own distinct features and characteristics which have a major impact on turns taking development (Reyes and Tchounikine, 2004, Bente and Krame, 2011). Findings from previous research suggest that the unique features of text-based chats affect turns order, turn size and the conversational floor (Reyes and Tchounikine, 2004, Simpson, 2005a, Vandergriff, 2010, Bente and Krame, 2011, Gibson, 2014), and therefore, the study of such interactions could inspire me as to how the dialogue process can be managed. For managing the dialogue, Botocrates needs to deal with the flow of conversation according to the current circumstance in order to determine the next action that, in turn, affects the turn taking system (Ries, 2008, Brkic, 2009, Nolan, 2014). Ries (2008) states that,

> The interaction between the user and the system can be conceptualised as a series of turns or a dialogue managed by a dialogue manager…in each turn, the user' input is collected, processed to recognize the user's intention, compute a response and present an answer.
>
> (Ries, 2008, p.393)

There is another major area of interest for gathering the online chats that is as important as the identification of Botocrates' dialogue strategies, tactics and how the dialogue could be managed. The use of the transcripts of the synchronous online chats can also help in building Botocrates' knowledge base. The goal of Botocrates is not only questioning and challenging the user, but also Botocrates should be able to provide information about the specific domain of knowledge (L'Abbae and Thiel, 2003, Hong and Cho, 2003, Abu Shawar and Atwell. 2007a). Feeding Botocrates' knowledge base with adequate information would enrich and maintain the discussion between Botocrates and users (Cassell, 2000, Lim et al, 2011). Sufficient knowledge about this particular context would enable Botocrates to generate and develop argumentation processes (Stein and Miller, 1991, Andrews, 2010, Chinn and Clark 2013). One of the significant and challenging tasks of the agent's creator, in particular, the educational conversational agent is to be able to identify and extract particular data from the entire context-relevant corpus that could be integrated in the agent's brain (Gasperis et al, 2012).

Procedures of recording and collecting Text-based chat data

The process of gathering the data started after gaining the permission from the School of Education at the University of Leeds and the students enrolled in the module (see section *4.6 Ethical Considerations*). Gaining access to the VLE and the module web page on the internet was obtained by means of the module tutor. The tutor set up an account for me in order to have access to the online seminars room and the discussion board provided on the VLE. The discussion board encompasses multiple threads that are divided according to the weekly topics. One of tutors' practices that facilitated the data collection process is that each week the tutors copied and pasted the transcripts of students' chats in the unit's thread on the discussion board. The Adobe Connect platform, where the online seminars take place, contains a feature that allows the tutors to email the transcripts of the online seminars to their own email accounts. After receiving the transcripts on their email, the tutors copy and paste the text on the discussion board. The logs of all online seminars were gathered from the discussion board. The real names of students participated in online chats were replaced by pseudonyms in order to anonymize the data.

Data Analysis

Discount scheme

There are different approaches to studying discourse which differ according to the purpose of the study (Mercer, 2004, Wodak et al, 2008, Jurado 2015). For example, analysing discourse could apply to a quantitative approach to analysis, when the study is based on counting the letters, the number of words, and the length of the sentence, to indicate the active and passive participants in the dialogue (Pilkington, 1999, Davies et al, 2014, Dascalu, 2013). This approach can be applied when there is a need to investigate the balance between students' participations during the discussion (Walker, 2003). However, exploring the use of language, the mechanism of turn-taking, and the role of interlocutors during the dialogue require different levels of analysis such as exchange structure and moves analysis (Kneser et al, 2001, Pilkington and Walker, 2003a, Cox et al, 2004, Guldberg and Pilkington, 2007, Kitade, 2012).

One of the aims of the analysis in this phase is to identify the features and strategies of dialogue needed to be integrated in the interactive scenarios that Botocrates needs to consider to support academic argumentation skills.

> The goals of educational dialogue analysis are to identify the features that distinguish instructional discourse from other types of discourse and to determine what makes it effective.
>
> (Pilkington, 2001, p.6)

Designing a pedagogical agent that aims to engage students in a constructive and meaningful dialogue requires dialogue modelling (Pilkington, 2001, Yuan et al, 2002). Dialogue strategies of a conversational agent are responsible for determining the next action that could lead to achieving the final goal of the dialogue (Aagesen et al, 2004, Perez-Marin, 2011). Therefore, it is absolutely necessary for the study to apply an analysis scheme that can enable the research to investigate the sequences of moves (Carlson, 2012, Lehman et al, 2012, Ravenscroft, 2013). Modelling argument can be described as the road map for the process of argumentation. This process of argumentation is implemented by means of a series of moves (Walton, 2013b and 2015). Incorporating these types of moves within the mechanism of dialogue could help Botocrates in accomplishing the purpose of the dialogue (Woolf, 2010, O'Shea et al, 2011).

The study, at this stage, applied the Discount scheme proposed by Pilkington (1999). The Discount scheme was based on the previous work of Sinclair and Coulthard, (1975) and Stubbs (1983). The original works of Sinclair and Coulthard (1975) and Stubbs (1983) are explained earlier in this thesis (see chapter 3, section *3.2 Exchange structure*). The nature of inquiry, context and the objectives of the research play crucial roles in determining the analytic process of the data (Morse and Singleton, 2001, Wallace and Van Fleet, 2012). There are three reasons that lie behind choosing the Discount scheme for analysing online text-based chats in this study. The first rationale is due to the applicability of the Discount scheme for computer-mediated dialogues analysis (Pilkington, 1999, Lim and Sudweeks, 2008a, Richardson, 2010). The second reason for selecting the Discount scheme is that the scheme contains a list of moves that help in tracking, describing and evaluating the dialogue strategies (Pilkington, 1999). At the centre of the Discount scheme is a set of classes that refer to acts of speech called 'moves' (Kneser et al, 2001). The sequence of purposeful moves can be regarded as 'tactics' that are intentionally planned to serve the specific goal of the dialogue (Pilkington, 1999, p.19). The third motive is the ability of the scheme to identify the characteristics of the active roles that can be indicative of exploratory talks (Pilkington, 1999, Kneser et al, 2001). One of the key tasks that Botocrates should be able to emulate is the capability to shift the dialogue to be exploratory and argumentative, by effectively adopting more active roles to encourage the other party (during the interaction) to take more reflective roles (Mercer and Hodgkinson, 2008, Littleton and Mercer, 2013).

The research employed the Discount scheme to analyse students' dialogues in online chats in different levels: ESA and moves levels. ESA was used because it helps to discover the mechanisms regulating the flow of discussion, and to investigate whether students are active or passive in their exchange roles (Kneser et al, 2001). The distribution of active and passive roles in online chat, in turn, will give us an insight into the extent to which students were engaging with each other's contributions, and in particular, will examine their engagement in exploratory and argumentative discussions (Pilkington, 1999, Pilkington, 2001, Kneser et al, 2001). However, ESA does not always give an indication of students' engagements in repair works, such as critiquing and clarifying moves, but the analysis of moves has to be taken into account as well (Kneser et al, 2001). *Table 13* & *14* illustrate the Exchange Structure and moves categories proposed by Pilkington (1999) with the description of each element.

Code	**Category**	**When exchange is well formed**				**Descriptions**
		Initial	Predicting	Predicted	Terminal	
I	Initiate	Yes	Yes	No	No	Initial turn of exchange
R	Respond	No	No	Yes	can be	comments on a previous turn or answering a question
RI	Re-Initiate	No	Yes	No	No	Comments on a previous turn that anticipate a response critiquing/enquiries
RC	Response-Complement	No	No	No	can be	Comment on a response that can include a feedback or acknowledgment
N	Neutral	No	No	No	No	e.g. 'um', 'er-hu' or nods of the head
SA	Stand Alone	Describe a sequence of turns for active/passive determination				A sequence of turns made by the same participant

Table 13: Exchange Structure categories proposed by Pilkington (1999, p.21)

Initiate and Respond categories in ESA	
Initiate (I)	A contribution that anticipates a response and is not predicted from a previous turn.
Respond (R)	A contribution that is not initial does not anticipate a turn and usually completes an exchange.
Reinitiating (RI)	A contribution that is a continuation of a current exchange and anticipates a response, but was not predicted from an earlier turn and was not initial. Reinitiating can be a negative feedback.
Response-complement (RC)	A contribution that can be acknowledgement, feedback or evaluation. Response-complement signals intention to close the exchange, however, it can be followed by a new change.
Stand-alone (SA)	Contributions in which one participant continues to initiate, and where turns by the same speaker follow each other.
Ill-informed turn (II)	A contribution that is an island, with no response to it.
Disregard	a contribution that is not related to the argument or off-topic contribution e.g. , greetings , internet connection problems, etc.

Table 14: Definitions of ES Categories

(Carr et al, 2004, p.199, Wishart and Guy, 2009, p.134)

As Table 14 illustrates, in addition to the (I, R, RI, RC, SA, and II) categories, a new category was added and labelled as 'Disregard' that covers any online connection problems and 'greetings' turns. The purpose of adding this type of classification is to focus mainly on related topic contributions.

Disregard	a contribution that is not related to the argument or off-topic contribution e.g. , greetings , internet connection problems etc.

The transcript below was extracted from the online chat and shows examples of the Disregard turn:

Turn	Examples	Categories
	NIV: Hello there	D
	NAE: (oops - wrong room - REN is room 2 - sorry)	D

Example 22: Disregard category

Turn	Examples	Categories
	NIV:How often do you use the types of CMC??	I
	HOO:daily!	R
	SUL:I used it almost ever class ^^	R
	NIV:Did the affect the way you communicate with these peolle over the years?	I

Example 23: ‘Initiate’ (I) and ‘Respond’ (R) categories

Turn	Examples	Categories
	NIV:But would you do that if you had to write a letter or write a msg to your tutor?	I
	ASY:Do what?	RI

Example 24: ‘Re-initiate’ (RI) category

Turn	Examples	Categories
	SAR: do you prefer to use synchronous or asynchronous types of communcation	I
	NAS: It depends on the purpose of communication i believe	R
	SAR: great NAS!	RC
	REN: Yes I agree with NAS!	RC

Example 25: ‘Response-complement’ (RC) category

Typical Role	Move	Description
{{*Initiating *}}		
	{*Open*}	Begin the dialogue
	{*Meta-statement*}	Talk about self, other, the task or discourse e.g “You said …” “Let’s talk about…”
	{*Finish*}	Attempt to end the dialogue

Table 15: Initiating moves (Meta-statement)

(Pilkington, 1999, p.24)

Typical Role	Move	Description
{{*Initiating *}}		
	{*inform*}	Describe/differentiate by stating fact or opinion
	{*Reason*}	State causal proposition including Goal, problem solution, contradiction and support(for alternative hypotheses)
	{*Direct*}	Instruct to perform a task action e.g. “Put that one down”
	{*Suggest*}	Suggest a task action or plan e.g. “ Do you think we should put this one down”
	{*Observe*}	Make an observation

Table 16: Initiating move, Inform (Describe/differentiate)

(Pilkington, 1999, p.25&26)

Typical Role	Move	Description
{{*Initiating *}}		
	{*Inquire*}	Ask question for a general inquiry e.g. what is it? What’s it made of?
	{*Challenge*}	Ask question to elicit a defence of a line of argument
	{*Explore*}	e.g. What will happen if you do that?
	{*Bid*}	e.g. Can I do this one?
	{*Hint*}	Draw attention to by asking question when know answer e.g. is this important?
	{*prompt*}	e.g. Could be silent
{{*Reinitiating *}}	{*Check*}	e.g. is that OK?
	{*Clarify*}	Ask a clarification question e.g. Do you mean this one?

Table 17: Initiating move, Inquiry (Elicit information)

(Pilkington, 1999, p.28&29)

Typical Role	Move	Description
{{*Responding*}}		Move given in response move
	{*Accept*}	Working commitment e.g “OK”
	{* Agree *}	Agree (explicit commitment e.g “Yes”, “Right”)
	{* Withdraw *}	Retract or negate- state not the case (+ Disagree)
	{* No comment *}	May or may not be the case) (- Disagree)
	{* Permit *}	Grant a request
	{* Deny *}	Refuse a bid or suggestion
	{* Reply (Inform) *}	Answering inquiry or other question with appropriate inform
	{* Justify *}	Reply with evidence or contradiction
{{*RComplement*}}		
	{* Feedback *}	e.g “that’s fine, good”

Table 18: Responding and R-Complement moves

(Pilkington, 1999, p.30)

4.5.2 Phase two: The evaluation of Botocrates’ prototype

The aim of this stage of the study is to examine the usability of Botocrates. The usability of any system is defined as “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use” (Spiliotopoulos et al, 2010. p.xvii). The evaluation process of Botocrates’ communicative performance was designed to assess whether the goal of designing Botocrates has been achieved or not. Evaluating the performance of any conversational agent should take into consideration measuring the efficiency of the agent in achieving the purpose of the design (Foster, 2007, Crockett et al, 2011, Nishida et al, 2014). Although Abu Shawar and Atwell, (2007b) proposed different evaluation metrics for chatbots’ evaluations such as dialogue efficiency metric regarding matching type, dialogue quality metric in terms of the response type and users’ satisfaction by getting feedback from users, they concluded that, “if the chatbot is meant to be adapted to provide a specific service for users, then the best evaluation is based on whether it achieves that service or task” (p.96).

The research employed two different methods for evaluating Botocrates’ performance: a) analyzing the logs of the chats generated from Botocrates and users interactions, and b) exploring students' opinions and experiences after conversing with Botocrates by means of interviews.

Sampling

The main concern of this stage of the research was to find participants who were willing to participate in the research. Agreeing to contribute in this stage of the research means that participants should be involved in two commitments: a) chatting with Botocrates, and b) being interviewed by the researcher. As the aim of the study is to investigate the topic in depth, it is vital to recruit participants who are willing to cooperate with the research (Creswell, 2013, Jones et al, 2013). The degree of users' readiness to take part in this study could contribute to better articulation of the meaning of their experiences when chatting with Botocrates (Hackett, 2015). This type of sampling is called 'convenience sampling' in which the researcher chooses participants on the basis of readiness and availability (Howard, 2015, Yin, 2015). Convenience sampling includes the use of volunteer/self-select sampling processes (Sim and Wright, 2000, Utts and Heckard, 2005). It could be said that the limitations of any non-probability sampling such as convenience sampling should be considered when drawing conclusions or stating claims generated by the analysis of the findings (Patton 1990, Patton, 2014, Bryman, 2012, Erford, 2014). The argument here is similar to the one illustrated in the sampling process of the first phase of the research with regard to the generalization (see section *4.5.1 Modelling Botocrates' prototype,* sampling).

The selection of the module *Technology Enhanced Language Learning*, was based on the fact that more students were enrolled in it than in any other module during semester two in the MA ICT/ELT in Education course. The study purposely selected a large number of enrolled students because the more students enrolled in the module the more participants would agree to be involved in the study. Emails were sent to all students who registered in the module to invite them to take part in stage two of the study.

The respondents who showed their willingness to take part in the study were 7 participants. Two participants were recruited for conducting the first set of the pilot experiments and five participants were employed for carrying out the main evaluation. Each participant that participated in the WOZ experiments was immediately interviewed after the chat session. The study conducted two phases of the WOZ experiments. Each phase of the experiments had particular goals to achieve. The first set of the WOZ experiments was carried out to check the initial version of the design and the second phase was aimed at conducting the main evaluation.

Table 19 shows the number of participants in each phase and the size of their contributions when chatting with Botocrates.

The Sample size of the evaluation stage				
Sessions	Total Numbers of turns		Total number of moves	
	Botocrates	User	Botocrates	User
The pilot experiments				
HIS	22	22	31	28
RAH	31	31	42	39
The main evaluation				
ALE	34	34	53	50
KAY	29	29	44	33
PAR	14	14	25	20
BAT	28	28	46	38
SES	12	12	25	13
Total	170	170	266	221

Table 19: The contribution size during the chat with Botocrates

There are different factors which were taken into account when determining the sample size at the evaluation stage, such as the time scale of the research (Denscombe, 2014, Ryan, 2013, Newby, 2014), and the nature of research which involves discourse analysis (Wood and Kroger, 2000, Bowles and Seedhouse, 2007). The researcher needs to consider the time-consuming nature of discourse analysis (Wood and Kroger, 2000, Phillips and Hardy, 2002). The manual annotation of a dialogue corpus in terms of conversational and communicative intentions has been described as a hard, annoying and time-consuming task (Ohtake et al, 2010, Ghigi et al, 2014).

Data Collection

The Wizard of Oz

The WOZ technique was used in the study to examine Botocrates' interactions with users. The name of this approach, 'WOZ' is derived from a children's novel called 'the Wonderful Wizard of Oz' in which the Wizard of Oz is hidden and he talks to the other characters from behind a curtain. In this study, the wizard played the role of Botocrates to simulate the computer side of HCI. The WOZ experiment is seen as an efficient technique for data collection that enables developers to test the usability their applications (Sadowski, 2001, Lazar et al, 2010, Parshall et al, 2012, Boudy et al, 2013). This technique allows the designer to test the functionality of the proposed application by pretending to be the machine (Kotelly, 2003). The WOZ method has been widely used to evaluate novel applications that are not fully designed, especially, during the very early stage of the design (Petrie et al, 2002, Kerly et al, 2006, Bradley et al, 2008, Webb et al, 2010, Lopez-Cozar et al, 2011, Nishida, 2012, Mencia et al, 2013).

By emulating the intelligent behavior of Botocrates, using the WOZ experiments, the research aimed at achieving two objectives: a) evaluating the outcomes of the interactions between Botocrates and users, and b) exploring users' behaviors, experiences and attitudes. These two objectives were designed to address the main research question of the evaluation stage 'what happens when learners interact with Botocrates?'The logs generated from the interactions between the wizard and users were recorded and analyzed. The evaluation of the agent's effectiveness was explored in terms of two issues: task success and dialogue performance (Hung et al, 2009). While dialogue performance is concerned with how the dialogue was performed, task success is aimed at exploring the usefulness of the interaction (ibid). The outcome of the experiments can also serve in gaining an in-depth insight into users' satisfactions and experiences which assist the developer to update and refine the original design (Andrews and Quartenroni 2011, Sagae et al, 2011). Following the WOZ experiments, students who participated in the stage were also interviewed in order to discover their satisfactions about Botocrates.

Previous studies reported the usefulness of utilizing the WOZ method for examining the dialogue strategies of proposed systems (Whittaker et al, 2002, Rieser and Lemon 2008, Bradley et al, 2009, Webb et al, 2010). During the WOZ experiments, the wizards used the initial schemes of dialogues to guide the interactions with users. The experiments enabled the designers to identify particular situations during the interactions which, in turn, helped in the refinement processes of the applications. During this stage, the wizard simulated Botocrates' dialogue management system to analyze users' inputs and produce appropriate responses. The actions of Botocrates during the dialogue were prearranged to implement sequences of moves according to the users' inputs. Boudy et al (2013) employed the WOZ in their study to perform the role of the dialogue manager. The wizard acted as a substitute to link the users' inputs with the best related answers. The tasks of the wizard were predefined and based on a set of predesigned rules. Boudy et al (2013) concluded that the WOZ method is not only an effective prototyping technique for data collection, but also it is a very useful instrument for evaluating systems. Andrews and Quartenroni (2011) suggest that the exploratory experiment of the WOZ is a powerful method for verifying the effectiveness of the proposed scenario and the dialogue moves.

It could be said that the flexibility, efficiency and zero cost are some of the advantages that motivate developers to adopt this approach (Lisowska et al, 2005, Martin et al, 2012). However, the researcher should take into account the limitations of methods applied in the study and, in particular, to which extent these limitations can affect the final claims (Sherman and Webb, 1988, Ercikan and Roth, 2009). One of the challenges facing a researcher when conducting the WOZ experiments is how to avoid the subjective selection of the wizard's responses (Sadowski, 2001). Therefore, the wizard is required to undertake extensive training sessions using clear rules to ensure better credibility (Anathan et al, 2013). The well-trained wizard is able to follow the predefined instructions which lead the wizard to achieve consistent acts (Hagethorn et al, 2008). In addition, it could be claimed that the findings from the WOZ experiments are idealized because it is impossible for the wizard to simulate machine errors (Jurafsky and Martin, 2009, Xuan, 2013). But, the aim of utilizing the WOZ experiments in the study is justified because the design is still in the exploratory primary stage (Kerly et al, 2006, Lopez-Cozar et al, 2011, Mencia et al, 2013). Martin et al (2012) suggest that before spending time and money on a new innovative application, the WOZ method is very valuable especially in the early stage of the project when aiming at investigating the feasibility of the proposed solution.

The research study has conducted two stages of the WOZ experiments. The goal of the first set of the WOZ was to check the initial design of Botocrates' prototype (Cypher and Halbert, 1993). The rationale for conducting such experiments before executing the main evaluation of Botocrates' functionality was to maximise and improve the efficiency of the initial version (Ruttkay and Pelachaud, 2004, Yaghoubzadeh et al, 2013). Testing the design of the first version with a few numbers of users can help in discovering shortcomings and the limitations of the proposed version (Gibbon et al, 1998, Melichar and Cenek, 2006). The second set of the WOZ experiments was executed to conduct the main evaluation.

Procedures of recording and collecting Wizard of Oz data

The participants who agreed to take part in the study were asked to choose the most convenient time for them to do the experiment. According to their responses, each participant was allocated a different time slot to chat with Botocrates. Before the experiment, the link to the chat platform was sent to the user and she/he was asked to log in to the platform. The researcher created a chat platform in the Adobe Connect software provided within the VLE at the University of

Leeds. Prior to the experiments, the participants received the following instructions from Botocrates for the chat (also these instructions were displayed in the chat window):

- Because my brain is under construction, the reply might take a few seconds before it appears on the screen.
- Please do not send two or more consecutive messages before I reply to the current one.
- You can start and end the chat anytime.

Figure 14 shows a screenshot for the chat platform where the WOZ experiments took place.

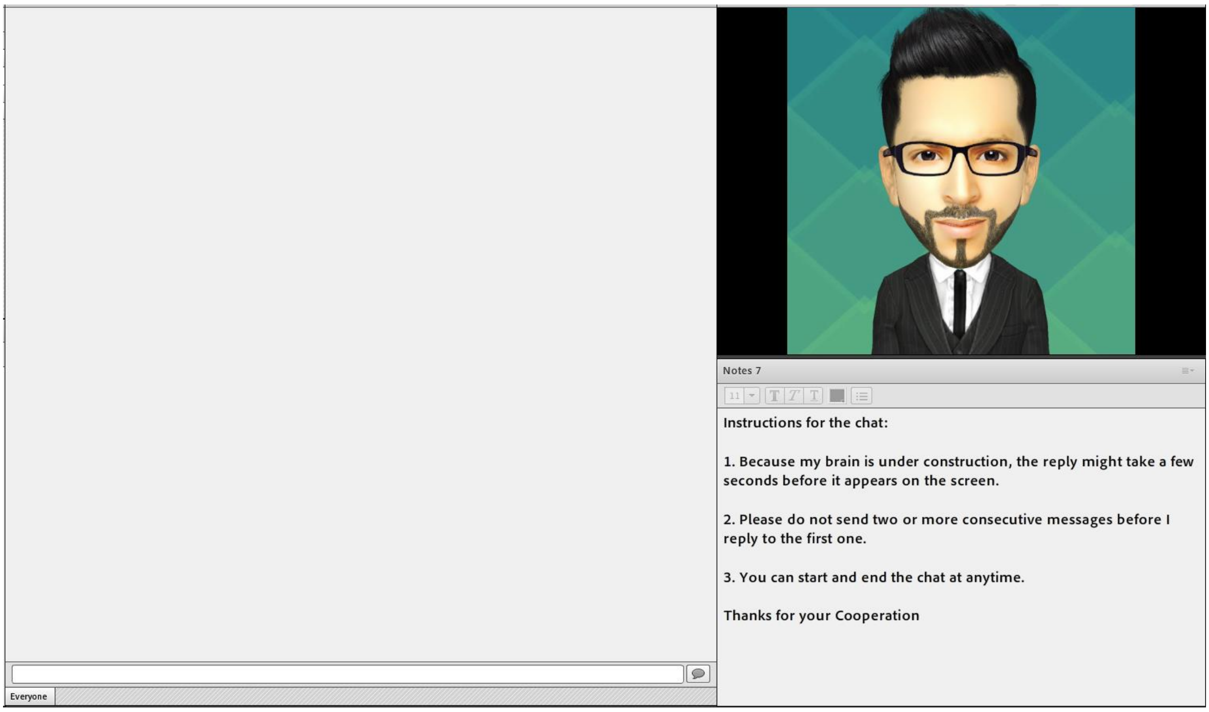


Figure 14 Botocrates' Interface

The chat platform contains a feature that enables the researcher to email the logs of the chats to his own email. After receiving the logs extracted from the WOZ experiments, the transcripts were edited and the names that appear on the logs were replaced by pseudonyms.

The WOZ experiments were conducted in two stages. Two participants took part in the first set of the experiments and five participants contributed in the second stage. In the first stage, the researcher played the role of the wizard. In the second stage, the main evaluation, a fellow PhD student was asked to play the role of the wizard. Although the researcher is the one who usually plays the role of the wizard in the WOZ experiments (Riek, 2012, Martin et al, 2012, Valverdu, 2014), this study has two rationales for employing someone else, apart from the researcher, for doing the second set of the WOZ experiments. The first motive for asking another person to play the role of the wizard is the need for extensive training sessions before the implementation of the main evaluation. The training sessions mean two parties should be involved: the person who played the role of the potential users and the wizard. The training sessions are very important for ensuring the acts of the wizard during the interaction can reflect the design (Anathan and Mihalidis, 2013). The second motive is the importance of having clear guidance, (that can be applied by anyone), related to the interaction process for improving the validity and the reliability of the experiments (Xiangdong, 2012, Anathan and Mihalidis, 2013).

Behind the scene

During the interaction, the wizard emulates the roles of Botocrates for managing the chat which includes: a) recognizing the communicative intentions of the user, b) deciding the next action, and c) generating Botocrates' response. As soon as the user has sent a contribution, the wizard starts the process by classifying the dialogue acts made by the user. For performing this step, the wizard has been given a decision tree and tables designed for this purpose (see chapter 6, sections *6.4 Academic Argumentation Machine AAM* & *6.5 Scenario and dialogue modelling*). The second step is deciding the next action that should be made according to the dialogue strategies and tactics as proposed in chapter 6. The final step is the generation of the responses in which the wizard selects the content of the response from the Knowledge base (KB), Academic Argumentation Bank (AAB) or from the 'canned' conversational moves. The KB and the AAB are stored in an Excel file as shown *Figure 15* & *Figure 16*. The Excel file consists of 4 worksheets (KB, AAB, 'canned' argumentation moves e.g. "*why do think that*?" "*Is that relevant? Can you explain more*", 'canned' feedback e.g. "*your disagreement should be based on reason*", "*that sounds valid argument*"). Section *6.5 Scenario and dialogue modelling* illustrates these steps in more detail.

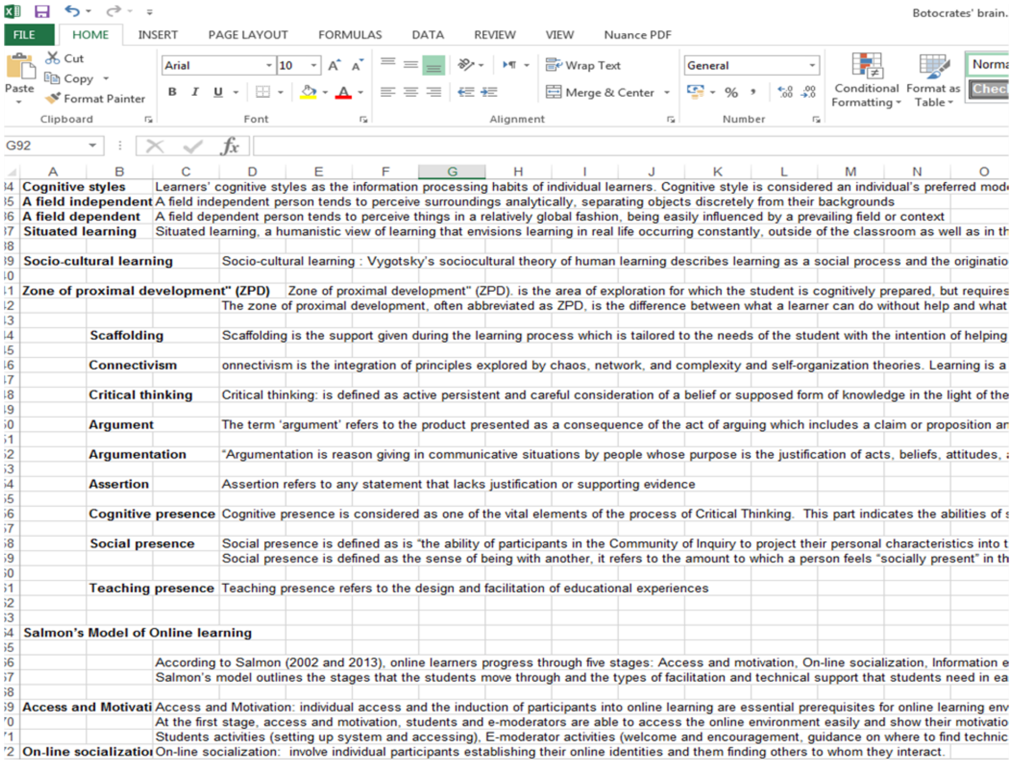


Figure 15: Botocrates' knowledge base (KB) during the experiments

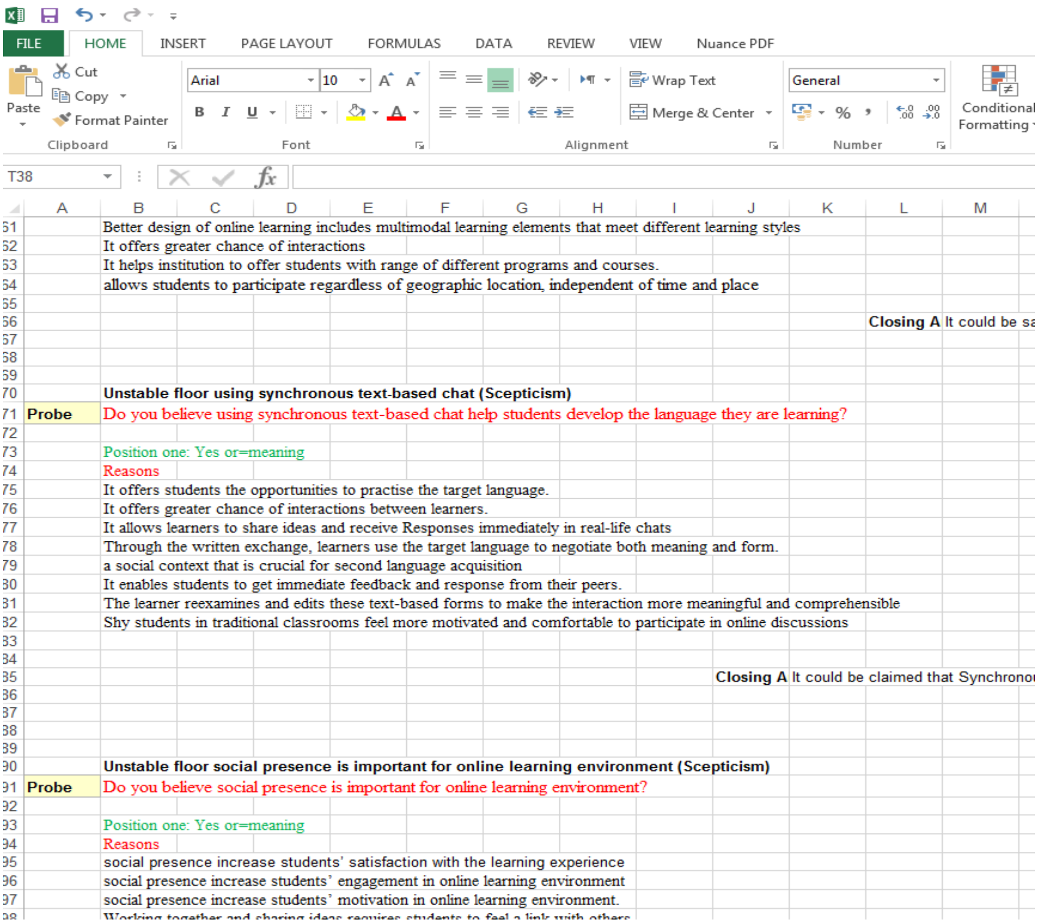


Figure 16: Botocrates' Academic Argumentation Bank (AAB) during the experiments

In order to control the topics under discussion, the participants were informed that Botocrates' brain is under construction and he is happy to chat with you about two units (two & three) of the module *Technology Enhanced Language Learning*. The rationale for doing this is to be able to reasonably construct the KB that can fulfil the user's *Request-Info* moves.

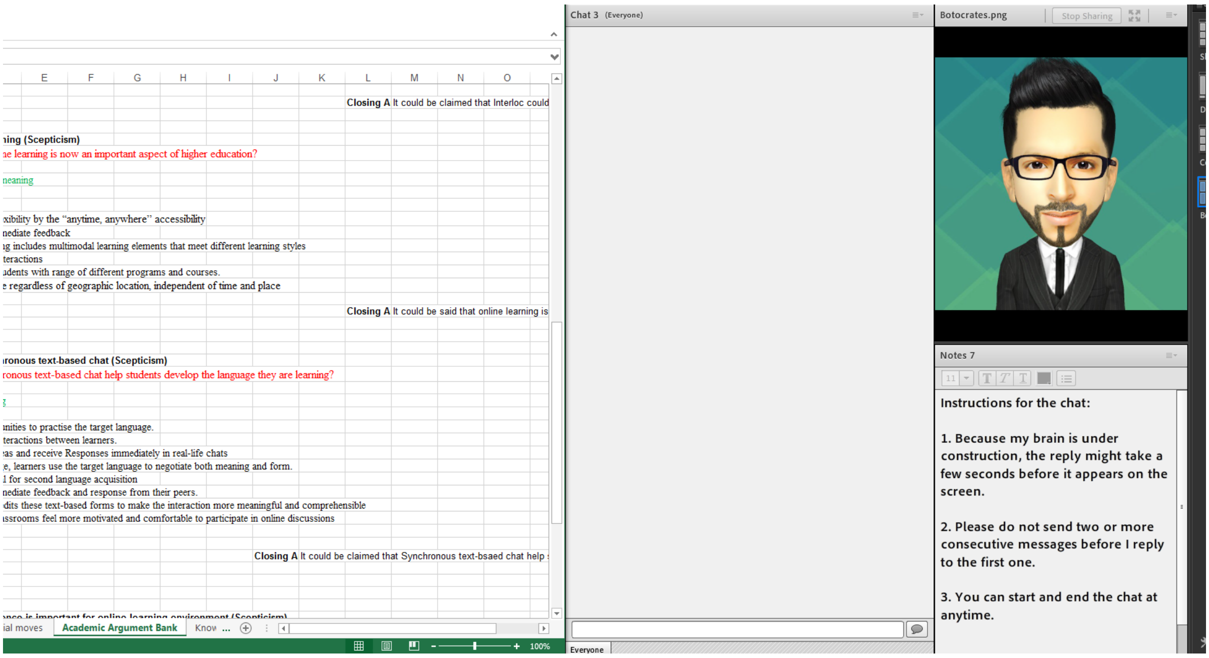


Figure 17: Screenshot of the wizard's screen during the experiments

Acknowledgment

Some of the contents of Botocrates' KB and AAB were quoted from related books & articles. The sources of some of Botocrates' responses retrieved from Botocrates' KB or AAB were:

(Salmon, 2000 & 2002, Kear, 2011, Donnelly, 2008, Moule, 2007, Smith, 2005, Prensky, 2001, Jones and Shao, 2011, Dunkels, 2011, Rahimi, 2015, Helsper and Eynon, 2009, Druin, 2009, Wegerif, 2007, Ravenscroft et al, 2007, Scharl, 2013, Iskander, 2007, Felix, 2003, Koh 2015, Pethuraja, 2015, Tomei, 2008 & 2010, Inoue, 2007, Lai et al, 2006, Park and Bonk, 2007b, Johnston et al, 2005, Lee, 2002, Vonderwell, 2003, Kear et al, 2014, Luppicini, 2007, Kyei-Blankson, 2013, Gibson, 2009, Hudson, 2013, Stacey, 2009, Yuzer, 2014, Anastasiades, 2012, Juwah, 2006, Pearn, 2003, Anderson, 2008, Carliner, 1999, Khan, 1997, Ally, 2004, Ivala, 2013, Heafner, 2014, Yodkamlue and Carolina, 2008, Fuller, 2010, Cooke, 2007, Weegar and Pacis, 2012, Hussein, 2006, McLeod, 2003, Batson, 2011, Siemens, 2004, Camilleri et al, 2007).

Interviews

An interview is defined as a meeting intentionally arranged between a researcher and participants to explore their perspectives and experiences about the phenomenon being investigated (Kvale, 2005, Cohen et al, 2013). Interviews are one of the most fruitful and rich sources of information in a qualitative research (Yin, 2009, Lodico et al, 2010, Hammersley, 2013). In this study, interviews provided data needed to assess Botocrates from users' perspectives, by means of gathering students' descriptions of their opinions, attitudes, and the successful and unsuccessful experiences when chatting with Botocrates (Anderson and Arsenault, 2005, Thomas, 2013). Interviews are ideally suitable for the purpose of seeking answers to research questions related to participants' experiences and practices (Braun and Clarke, 2013). It is a flexible method for gathering data (Cohen et al, 2013), that enables the researcher to collect detailed descriptions of participants' views regarding a specific issue (Patton, 2002, Holloway, 2005). The key to conducting a good interview is to pay more attention to the type of questions that should be designed to meet the aim of the investigation (Merriam, 2009).

It could be claimed that questionnaires are a more common method in evaluating conversational agents than interviews (Kerly and Bull 2006, Mencia et al, 2013, Griol et al, 2014, Tegos et al, 2014). The rationale for choosing interviews instead of other instruments, for exploring users' opinions about Botocrates, is that interviews offer more of an in-depth exploration of what is happening when students interact with Botocrates (Wilkinson and Birmingham, 2003). The data generated from users' interviews can help in exploring the real meaning of what is happening rather than focusing on "the surface elements of what is happening" (ibid, p.44). Having said that, interviews were not used for capturing the actual users' behaviours and their actions when chatting with Botocrates, but this qualitative method was employed to investigate only issues related users' perceptions about chatting with Botocrates (Holloway, 2005). During the interviews some considerations were taken into account such as satisfying the line of inquiry related to the aim of the study, and asking 'friendly' questions (Yin, 2009, p.107). The researcher aimed at creating a rich dialogue with the users that could uncover how students felt when chatting with Botocrates (ibid). In addition, the questions were carefully asked to the users by ensuring no hidden assumptions or ideas that may affect users' responses were imposed (Holloway, 2005).

Depending on the information being sought and the purpose of the interviews, there are different types of interviews: structured, semi-structured and unstructured interviews (Wilkinson and Birmingham, 2003, Scott and Usher, 2011, Cohen et al, 2013). While a structured interview is described as no more than a face-to-face questionnaire, since the interviewer has to follow specific and pre-determined questions without any flexibility, an unstructured interview on the contrary is a very flexible way of conducting interviews because the dialogue topic is guided by the participants (Wilkinson and Birmingham, 2003). However, for the richness and depth of students' responses about their experiences when chatting with Botocrates, the study adopted the semi-structured interview technique because it has some flexibility that enabled the researcher to set pre-determined questions, but at the same time participants could be asked for further detail, elaboration, and clarification (Scott and Usher, 2011, Cohen et al, 2013). Using the semi-structured interview allows the researcher to reorder and modify questions if an interesting issue is raised by participants that might lead to more noteworthy findings (Robson, 2002). Therefore, the semi-structured type of interview is preferred in an exploratory research study (Hennink et al, 2010). The following are examples of the questions asked during the interviews:

- *Tell me about your experience when chatting with Botocrates?*
- *How would you judge the clarity of Botocrates' response?*
- *How would you rate out of 10 your satisfaction with Botocrates' responses?*
- *Did Botocrates understand your questions as you meant them?*
- *If Botocrates is provided with each module, would you like to chat with Botocrates again?*

The Procedures of conducting users' interviews

The total number of the interviewees who participated in the evaluation stage was 7. Before each chat session, the participant was asked to decide when and how she/he would like to be interviewed (e.g. Skype, video, audio recording or taking notes etc.). The 7 participants preferred to do the interviews immediately after the chat sessions. In terms of the method of conducting interviews, it is important to choose the method which is suitable for each participant (Kervin, 2006). Participants' permissions regarding the method of interviews needed to be obtained before the interviewing started (Edwards and Holland, 2013, Maltby et al, 2014). Two participants agreed to be interviewed face to face (F2F) using audio recording, three participants preferred to meet via Skype to conduct text-based interviews, and two requested the researcher not to record their interviews and to rely completely on taking notes. *Table 20* shows the method of interviews used in each interview session.

Participants	Method of interview
HIS	F2F/Taking notes
RAH	F2F/Taking notes
ALE	F2F/Audio recording
KAY	Skype
PAR	Skype
BAT	F2F/Audio recording
SES	Skype

Table 20: Method of interview used with each participant

The interview with each participant lasted about 15-25 minutes. Each interview was transcribed after the interview session. In order to protect participants' anonymity and confidentiality (Wengraf, 2001, Magnusson and Marecek, 2015), the names of participants were edited after the interviews and replaced by pseudonyms.

Data Analysis

Analysing the logs of Wizard of Oz experiments

For examining the logs extracted from the WOZ experiments, different levels of analysis were conducted: a) ESA, b) conversational moves analysis, and c) conversational floor analysis. The motive of employing ESA was to explore the mechanism regulating the flow of the interaction (Kneser et al, 2001). ESA was also used to reveal the level of active and passive participations performed by both Botocrates and users during the interactions (Pilkington, 1999). The active and the passive roles during the interaction can be identified by comparing the numbers of Initiating (I), Reinitiating (RI), and some of the Response-complement (RC) moves such as feedback moves, with the numbers of Responding (R), and acknowledgment shown in Response-complement (RC) moves (Pilkington, 1999, Kneser et al, 2001, Walker, 2003b). Furthermore, the analysis of the patterns of exchange structure (Initiate (I), Respond (R), Reinitiate (RI) and Response-complement (RC)) during the interaction can provide an initial indication of whether users and Botocrates were engaging with each other or not (Pilkington, 1999, Kneser et al, 2001, Pilkington, 2001, Pilkington and Walker, 2003b), see *4.5 Collection and analysis of data*, section *Discount scheme*.

The conversational moves analysis was carried out in order to explore the communicative intentions of both Botocrates and users (Flor and Juan 2010, Holtgraves, 2013, Yule, 2014, Kissine, 2013). The interactional intentions can be recognized by investigating the types of conversational moves made by users and Botocrates (Pilkington, 1999). Such analysis can be adopted when there is a need to see whether Botocrates successfully completed the given tasks and sub-tasks or not (Pilkington, 1999, Walton, 2003, Psaltis and Zapiti, 2014).The success of Botocrates in terms of enhancing users' critical thinking and academic argumentation skills relies on generating a relevant set of dialogue acts such as *probe-opinion, ask-clarify, why-question, ask-explain* and *counter* moves. Moreover, the analysis of users' dialogue acts explains the effects of their conversational behaviours on the flow of dialogue (Taylor and Bouwhuis, 2000, Andre and Pelachaud, 2010). At this stage of the study, the dialogue acts used were adopted from previous studies and taxonomies of conversational moves (Jekat et al, 1995, Pilkington, 1999, Walker, 2003, Kluwer, 2011b), see chapter 6, section *6.5 Scenario and Dialogue Modelling*. It is essential to use the set of conversational moves that reflect the nature of interaction (Beveridge and Milward, 2003, Andrews and Quarteroni, 2011).

The third level of analysis was the conversational floor analysis (for more information about the conversational floor see chapter 3, section *3.3 Turn-taking*). Examining the types of floors resulting from the sequences of adjacency pairs, which occurred during the interaction can explain the whole structure of the dialogue (Edelsky, 1981, Franck, 1985, Sacks et al, 1974, Giachin and McGlashan, 2013). The analysis of the conversational floors explains which types of floor were dominating the final structure of users' interactions with Botocrates.

Analysing the Interview

This research adopted the thematic analysis approach for analysing the interview data. Thematic analysis can be defined as "a method for identifying, analysing, and reporting patterns (themes) within data" (Braun and Clarke, 2006, p.79). The nature of the investigation and the objectives of this stage of the research are the main motives in adopting such an analytical approach (Morse and Singleton, 2001, Wallace and Van Fleet, 2012). The rationale for using the thematic approach is the suitability of this approach for examining users' perspectives about the interactions with Botocrates. Among the advantages of employing this approach are the flexibility and the ease of exploring participants' live experiences (Braun and Clarke, 2006, King and Horrocks, 2010, Guest et al, 2011). Thematic analysis is a common practice in investigating the effectiveness of technology from users' subjective accounts (Spence, 2016). Different research in HCI suggests that the thematic analysis approach is valuable for investigating users' opinions about the use of software (Pykhtina et al, 2012, Frey et al, 2013, Brown and Stockman, 2013). In addition, this analytical approach is seen as an effective method of analysis for informing and modifying the design (Gorecky et al, 2012).

During the process of analysing the interview transcripts, the six stages suggested by Braun and Clarke (2006, p.87) were followed step by step. The first step is being familiar with the data by reading and re-reading the transcripts with the intention of generating initial ideas. This step helps the researcher to be immersed in the data which leads to discovering the key points from the body of text (Watson et al, 2008). The second step is indexing or coding the interesting features emerging from the data. The code can be defined as the smallest thematic unit which represents widespread issues across the interview data (Lynch, 2010). The third stage of the analysis is grouping or gathering the codes into initial related themes. A theme is defined as "a statement of meaning that runs through most of the data or that occurs for a minority of the participants but carries heavy emotional or factual impact" (Thatchenkery, 2009, 235). These themes are reviewed and re-organized in a bigger set of themes represented in a thematic map. The final thematic map or network of themes should reflect and represent participants' experience as a whole (Watson et al, 2008). The final themes from the interview analysis should be guided by the main aim of conducting the interview at this stage of the research which is exploring the users' perspectives (Daykin and Stickly, 2015). The fifth step is naming and labelling the final set of themes or overarching themes. The final step is producing the report of the analysis (as shown in chapter 7). *Figure 18* shows the final thematic map resulting from the interview analysis.

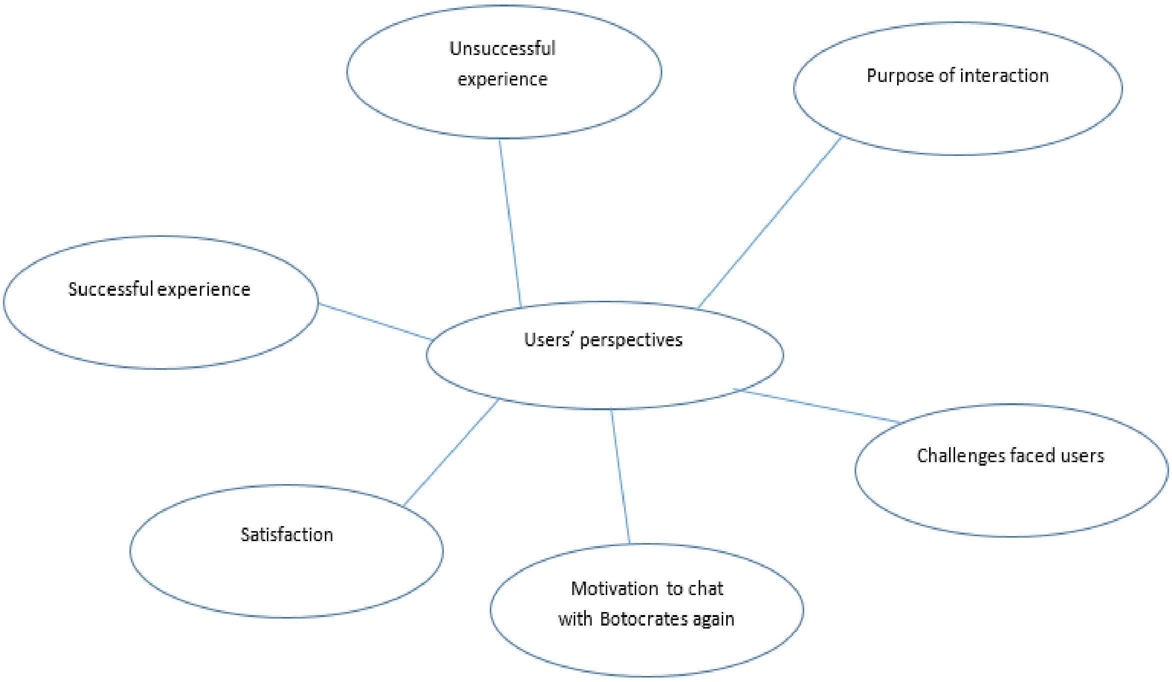


Figure 18: Thematic network for user's experience

Table 21 shows an example of the statement and codes related to the theme 'unsuccessful experience'.

Description of participants' unsuccessful experiences when chatting with Botocrates			
NO	Participant	Statements	Codes
1	ALE	*Just one occurrence when the robot did not really know what I was talking about.*	Not understanding users' input
		I think the issue is, if you ask for clarification and explanation, it gives you that, but if you did not understand that...I think that is as far as it goes	Need for further clarification
		I think when I need further explanation the robot has a limit.	Need for further clarification Limit in passing information
		He takes a bit of time to respond.	Response delay
2	KAY	*It needs secondary and alternative answers*	Need for further clarification
		Needs more context	Limited topics
3	PAR	*I felt disappointed because of the limited topics of the chat.*	Limited topics
		When using this tool I need to find answers to my questions	Limited topics
		He could not provide in-depth information	Not providing in-depth information
		As I expected some of the responses were formulaic.	The form of the response
		He throws questions back e.g why do you think that? is a bit annoying but forces a response.	Annoying question
		He took a bit of time to display the response.	Response delay
4	BAT	*I think that he needs more responses in order if I asked him questions he will have answers and I do not want him to say 'sorry I do not have an answer'. It was not nice to see that.*	Limited topics Limit in passing information
		When he cannot answer some questions he discourages the conversation.	Discourage the conversation
5	SES	*For some questions he did not give answers...* *Sometimes his answers were not clear.*	The limit in passing information Need for further clarification
		if you want to go deeper and you already know something in this field and you want to make it broader I think it quite hard for him because he sometimes did not gave proper answers	The limit in passing information Not providing proper responses

Table 21: Examples of codes and statements related to the theme 'unsuccessful experience'

4.6 The Quality of the Study

It can be argued that quantitative research is seen as more rigorous than qualitative research (Golafshani, 2003, Christie et al, 2000), because it is based on numbers and statistics rather than attitudes, perspectives and their interpretations (Thomas, 2010, Morse 2013). This argument is based on a misconception that using quantitative methods leads to more validity and reliability (Pershing et al, 2006). The quality of the study is linked to whether the criteria of rigor are considered or not (Pershing et al, 2006, Flick, 2007). While validity in quantitative study relies on careful construction of the instruments in order to make sure the study can measure what should be measured, the researcher is the most important instrument in a qualitative research (Patton, 2002, Cohen et al, 2013). Validity in qualitative studies refers to whether the results of the research are 'true' while accurately reflecting the situation and 'certain' when the findings are supported by the evidence (Guion et al, 2001, p.1). Yin (2015) states that, "a valid study is one that has properly collected and interpreted its data, so that the conclusions accurately reflect and represent the real world (or laboratory) that was studied" (p.78). The careful design of qualitative research is reported as central to increasing the quality of the study (Christie et al, 2000, Patton, 2002, Flick, 2007, Yin, 2015).

Yin (2009) suggests four criteria for judging the quality of the research design: construct validity, internal validity, external validity and reliability (p.40). Yin (2009) advises the researcher to identify the most appropriate and suitable operational measures for the phenomena being investigated. The aim of constructing the validity is to ensure that the instruments used in the study in building and evaluating Botocrates' prototype could provide meaningful data (O'dwyer and Bernauer, 2013). Although, the concept 'construct validity' is brought from quantitative research (Munhall, 2000), it should be addressed in qualitative research (Cohen et al, 2013, Olson and Jason 2015). During data collection, there are various tactics for constructing the validity, such as: 'the use of multiple sources of data', 'establishing a chain of evidence', and 'getting feedback from a key informant' (Yin, 2009, p.42). As illustrated earlier in this chapter, different resources were used for building and evaluating Botocrates' brain, and each method was justified as being the best method that could meet the aim of the investigation. Having sufficient evidence and getting feedback from my supervisors were considered as well.

In terms of increasing the internal validity of the study, some proposed tactics were used, such as the use of adequate citations and quotes in order to enable the readers to track my final conclusion that aimed at reflecting what actually happened (Yin, 2009, Ramanathan, 2009). Internal validity is sometimes referred to as 'credibility' which plays a crucial role in establishing the trustworthiness of the qualitative research study (Miles and Huberman, 1994, Miles et al, 2013). Credibility gives indications as to whether the researcher precisely represents users' and Botocrates' actions during the interactions, and users' feelings about Botocrates (Lodico et al, 2010). The use of a 'rich and thick description' can also help in deciding whether the findings could be transferred to another context or not (Creswell, 2012b, p.252). Moreover, in qualitative research, data triangulation can increase the internal validity of the research (Simons, 2009, Ramanathan, 2009). Data triangulation is defined as "a means of cross-checking the relevance and significance of issues, or testing out argument and perspectives from different angles to generate and strengthen evidence in support of key claims" (Simons, 2009, p.129). Yin (2012) suggests that a cross-checking technique is useful because the researcher will be able to eliminate any overlapping data. Another tactic that was employed in order to increase the credibility of the research study is peer review to check and discuss the process of collecting and analysing the data (Patton, 2014).

The third criterion, external validity, is concerned with whether the results of the research study can be transferred and generalized elsewhere (Yin, 2009, Hernon and Schwartz, 2013). The terms transferability and generalisation and external validity of the research have the same meaning and can be used alternatively (Yin, 2009 and 2015, Cohen et al, 2013). Ary et al (2009) states that,

> Although the qualitative researcher typically does not have a generalization goal, it is his or her responsibility to provide sufficiently rich, detailed thick descriptions of the context so that potential users can make the necessary comparisons and judgment about similarity and hence transferability.
>
> (Ary et al, 2009, p.501)

In this study, providing the readers with thick and rich descriptions were taken into account. Moreover, the transferability of the research findings could be judged when data collection and analysis are reviewed by experts in the field such as my supervisors and other colleagues (Ramanathan, 2009).

The fourth criterion is reliability (or dependability) which refers to the degree to which the findings of the research study can be replicable (Sensing, 2011, Merriam and Tisdell 2015). In other words, will another researcher be able to conclude the same results and findings again when following the same procedures illustrated by the earlier investigator (Yin, 2009). Increasing the reliability of the research study can be obtained when the researcher appropriately documents the process and the procedure of conducting the research study (Yin, 2009). A poorly documented study makes the external reviewer doubtful about the reliability of the used methods (ibid). In this research, these strategies were followed by extensively clarifying the research design and its procedures step by step, which in turn could increase the reliability of the study as well (Blank, G. 2008, Ramanathan, 2009).

Criterion	Tactics adopted in this study
Construct Validity	Using multiple sources of data for building and evaluating Botocrates
	Considering a chain of evidence
	My supervisors' and colleagues' feedback
Internal Validity (Credibility)	Using sufficient citations and quotes
	My supervisors' and colleagues' reviews
	Data triangulation
External Validity (Transferability)	My supervisors' and colleagues' reviews
	Rich and thick descriptions
Reliability (Dependability)	Documenting the research procedures as illustrated in the research design
	Appropriately storing the data by using external hard drive and the M-Drive at the University of Leeds.

Table 22: Steps for increasing the quality of my study

4.7 Ethical considerations

The main ethical issues taken into account during the research processes are: site access, informed consent forms, data protection, confidentiality and anonymity (Kvale, 1996, Dicks et al, 2006). At the early stage of my research, ethical approval was obtained from the Faculty Research Ethics Committee at the University of Leeds (see *Appendix F*). Before conducting this research, the School of Education at the University of Leeds was informed about the study by the sending out of an information sheet and the consent form (see *Appendix A*). After gaining access permission from the School of Education, participants were informed about the aims of this study by receiving an information sheet and consent form (see *Appendix B, C, D & E*). The consent forms were emailed to students in order to give them time to decide whether or not they would like to participate. The study ensured that students were informed that participation in the research is totally voluntary, and refusing to take part in the study would not affect them in any way. As the findings from the first stage (the logs of online seminars) and the second stage (the logs of the WOZ experiments and interviews) might be presented and published elsewhere, participants were made aware that anonymised data and findings from the study could be presented at conferences and/or included in academic publications. In addition, the gathered data that shows participants' real names gathered from online seminars, interviews and users-Botocrates interactions remained highly confidential (Wengraf, 2001, Magnusson and Marecek, 2015). The collected data were anonymised by replacing students' names with pseudonyms, and kept secure and safe, on my M-drive on the university server, from unauthorised access.

Chapter Five: Building Botocrates' prototype (stage one)
Analysis and Discussion of findings

5.1 Introduction

The aim of this chapter is to present the analysis and discussion of the data collected from the online seminars. The total number of the analysed logs in this chapter was 13 transcripts, which were edited and anonymised by replacing participants' names with pseudonyms before starting the analysis of the data. The chapter is divided into two main sections: a) the analysis of the results followed by b) the discussion of the research findings. In the data analysis section, the description of the results is supported with quotations and accompanied by supporting evidence drawn from the analysed data. The qualitative analysis of students' online chats was carried out in different levels: exchange structure, turn-taking and move analysis. The second section of this chapter contains the interpretations of the research findings and how these interpretations have helped and informed in the building of the Botocrates' prototype. In addition to the clarifications of the main findings and its interpretations, the possible limitations of the findings were considered before drawing any final conclusions (Stangor, 2014, Johnson, 2015). It must be borne in mind that the main aim of the analysis and the discussion in this chapter is not to evaluate the chat but rather the focus was maintained on the issues related to the goal of this phase of the study. In order to build and develop Botocrates' prototype, the central goal was looking at the raw data gathered from online chats from different angles, such as the rules and the structure of turn-taking, how and when students take turns, and the tactics and strategies of dialogues. The principal aims of data collection and analysis at this stage were achieved and the interpretations of the data, including the implications of the findings, provide inspiring insights into the development of Botocrates' intellectual actions.

5.2 Analysis of the Results

Exchange Structure Analysis (ESA)

The results from the 13 online chats revealed the asymmetrical nature of interactions among participants. Asymmetrical interactions in dialogue can be characterized by the lack of balance and equality between participants' contributions (Linell, 1998, Robinson, 2001, Brasdefer, 2015). For example, an asymmetrical conversation can be identified when some participants adopt active roles while the others are constantly passive in their exchange roles (Pilkington, 1999).

The analysis of the transcripts shows that some participants were active by initiating and asking questions whilst some students preferred merely to answer those questions. The findings also uncovered a notable difference in the numbers of turns among participants (for example see *Table 24* & *Table 25*). In conversation, a turn can be defined as a contribution that begins and ends by a specific speaker at definite time (Sacks et al, 1974). As shown in *Table 23* & *Figure 19*, participants tend to respond much more often than they initiate.

Sessions	No of Turns	D Turn	I Turn	R Turn	RI Turn	RC Turn	SA Turn	II Turn	Locus of Control in Dialogue	
									Active	Passive
U4AFR1	213	9	40	162	21	25	0	0	32.8 %	67.2%
U4AFR2	190	21	32	120	12	30	0	0	31.3%	68.7%
U4EVR1	208	15	50	149	13	21	0	0	36.2%	63.8%
U4EVR2	206	14	32	157	17	17	0	0	28.6%	71.4%
U5AFR1	217	22	33	139	24	23	0	0	32.8%	67.2%
U5AFR2	213	42	29	150	19	15	0	0	26.3%	73.7%
U5EVR1	279	43	35	192	12	29	0	0	22%	78%
U5EVR2	112	4	25	79	10	10	0	0	29.6%	70.4%
U5EVR3	175	6	24	143	10	30	0	0	21.8%	78.2%
U6AFR1	252	6	47	201	8	46	0	0	28%	72%
U6EVR1	153	14	35	105	6	18	0	0	33.8%	66.2%
U6EVR2	140	10	31	84	7	21	0	0	32.3%	67.7%
U6EVR3	259	20	46	160	6	51	0	0	22%	78%
Total	2617	226	459	1841	165	336	0	0	29%	71%

Table 23: Numbers of Exchange structure categories in 13 online chats

Note that the explanations and examples of the abbreviations mentioned in Table 23 are illustrated in Chapter 4 (section *Discount scheme*), see Table 14, p.118.

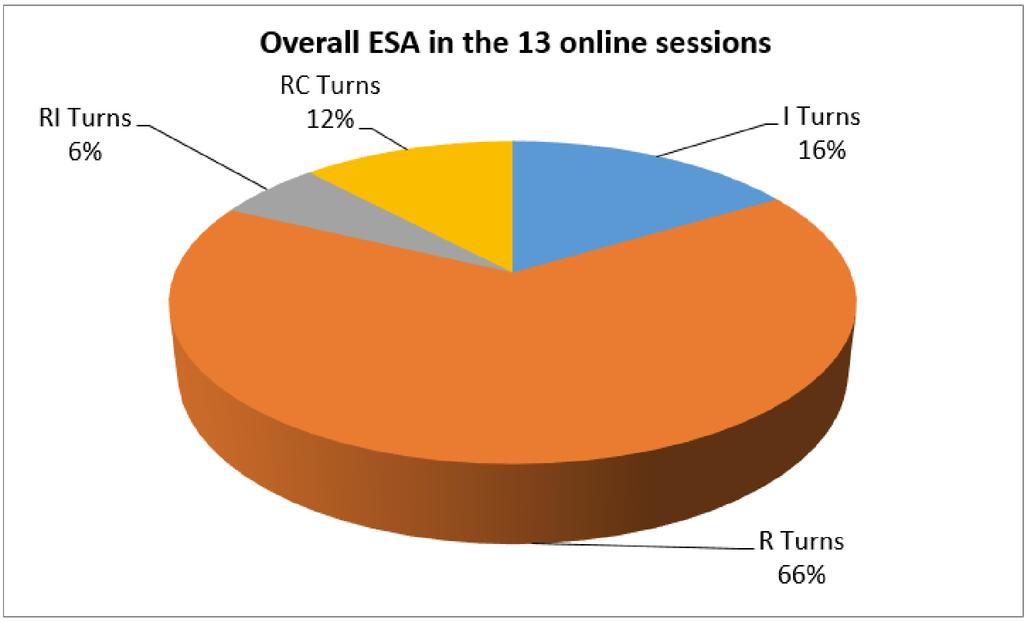


Figure 19: Overall ESA categories in 13 online chats

As *Figure 19* illustrates, Respond turns (R) accounted for 66 % of overall ESA categories, while the Initiate turns (I) represented 16%. While an Initiate (I) turn can be defined as an unpredicted participation that starts a new exchange and anticipates a response, a Respond (R) turn usually ends and closes the exchange as it does not predict a turn (Pilkington, 1999). The large proportion of Respond turns (R) compared to Initiate turns (I) is due to the nature of turn-taking in online text-based chat in which a single message in Initiate turns (I) receives multiple responses from different participants, see *Figure 20*.

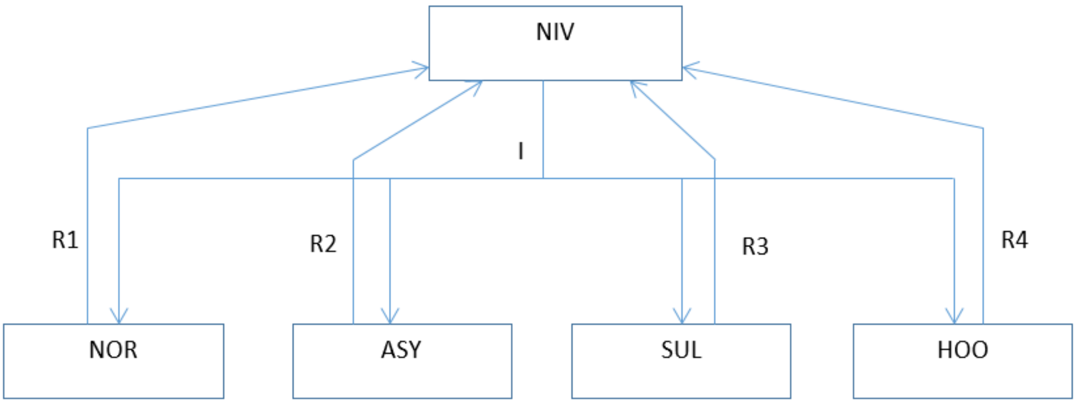


Figure 20: A single message receives multiple responses in text-based chats

Example 26 extracted from students' online chats explains the high numbers of (R) turns compared to (I) turns. As the example shows, one Initiate turns (I) in online text-based chats could receive multiple responses.

NIV: How often do you use the types of CMC??	I
NOR: daily!	R-1
ASY:I used it almost ever class ^^	R-2
SUL: Use FB and e-mail daily at home	R-3
HOO: Emails nearly every day apart from weekends	R-4

Example 26: A single message receives multiple responses in text-based chats

The results suggest the tutors successfully adopted a constructivist approach to learning. A constructivist approach supports the active role of learners by enabling them to take control and responsibilities over their own learning process (Gagnon and Collay, 2001, Swan et al, 2009, Orlich et al, 2009, Harasim, 2012). The seminars were facilitated by the module tutors who gave opportunities to the students to take some responsibilities for leading their discussions. The two given responsibilities are: a) managing the chats during the sessions, and b) taking notes and then posting them after the sessions on the discussion boards which are provided within the VLE. The main role of chat managers is to make sure that the list of questions, previously prepared by tutors designed to be discussed during the chats, will be covered during the sessions. In addition, the tutors succeeded in building a social and friendly online environment as students were greeting each other before the start of each session. As shown in *Table 23*, 226 turns were mostly reserved for welcome greetings (D=226). The Community of Inquiry model emphasises social presence as a very important element that indirectly facilitates the process of CT (Garrison and Anderson 2003, Garrison, 2011). Online facilitators should pay more attention to building a social environment and group cohesion in order to increase learning effectiveness (Park and Bonk, 2007b). However, giving students the control to manage the chats has both benefits and some limitations and constraints.

On the one hand, a positive outcome was when the initiator roles in all online sessions were not dominated by tutors, as occurs in traditional classrooms (Pitler, 2007, Johnson, 2008, Sullivan, 2013), but rather students who were selected as managers held the most initiative roles. In traditional classrooms, teachers are the most active and dominate and control about 80% of classroom talk (Silliman and Wilkinson, 2007, Zakaria and Iksan 2007), which can limit learners' opportunities to be engaged in argumentation (Newton et al, 1999). According to Kneser et al (2001), the initiator role can be identified when the Initiating turns (I) of a participant show a high number of his/her patterns of Exchange Structures compared to the Responding turns (R). For example, KHA, who was nominated as the manager of U4EVR2, was the most prolific initiator reporting about 59.3% of the overall initiating turn (I) during the session, see *Table 24* below.

Participants	No of Turns	D Turn	I Turn	R Turn	RI Turn	RC Turn	SA Turn	II Turn
NAE	34	2	10	18	5	5	0	0
ASE	46	4	2	37	4	3	0	0
FAI	29	4	0	30	1	1	0	0
KHA*	51	2	19= 59.3%	31	5	6	0	0
NAH	17	1	0	14	1	0	0	0
NIS	28	1	1	26	1	2	0	0
ARJ	1	0	0	1	0	0	0	0
Total	206	14	32	157	17	17	0	0

Table 24: Overall ESA categories of U4EVR2 session

* Indicates that KHA was the manager of the session

On the other hand, one of the limitations is that participants have insufficient skills of argumentation (Driver et al, 2000) and they are not adequately prepared to make such interaction productive and meaningful (Kneser et al, 2001, Halpern, 2003, Andrews, 2010). The findings show evidence of students' insufficient and low level of argumentation skills as we will notice later in this section (see section *Move analysis*). The results demonstrate that, students who took the role of managing the chat relied mainly on the list of questions previously prepared by tutors.

Participants	No of Turns	D Turn	I Turn	R Turn	RI Turn	RC Turn	SA Turn	II Turn	Locus of Control in Dialogue	
									Active	Passive
TUR	8	0	2	3	0	5	0	0	3	5
NIS	28	1	1	24	1	5	0	0	5	22
LOR	37	0	5	38	2	4	0	0	8	29
LAA	13	2	0	14	0	0	0	0	0	11
KHA	39	1	0	35	1	10	0	0	1	37
BAE*	50	2	16= 66.6%	29	6	6	0	0	20	28
Total	175	6	24	143	10	30	0	0	21.8%	78.2%

Table 25: Overall ESA categories of U5EVR3 session

* Indicates that BAE was the manager of the session

For instance, BAE, the manager of the U5EVR3 session who had the most Initiating turns (I) with 66.6%, see Table 25, during the session, made 12 *inquire* moves, see *Table 26*. The analysis of those *inquire* moves illustrates that BAE relied completely on the tutor's list of questions without any addition or amendment.

Moves	ESA category	TUR	NIS	LOR	LAA	KHA	BAE*
Inquire	I	2	0	3	0	0	12
Inform	I	0	1	2	0	0	2
Reason	I	0	0	0	0	0	0
Feedback	RC	1	3	2	0	3	1
Challenge	RI	0	1	0	0	0	2
Check	RI	0	0	0	0	0	2
Clarify	RI	0	0	2	0	1	2
Disagree + Justification	RI	0	0	0	0	0	0

Table 26: Overall active moves of U5EVR3 session

* Indicates that BAE was the manager of the session

It could be claimed that participants' contributions were shaped most of the time by the managers' questions that had already been designed by tutors. In other words, the findings suggest that if the list of questions that were previously prepared by tutors were not designed to generate argument, students would not be engaged in constructive and productive dialogue. The starting point of any argument requires seeking out the place of dispute (Andrews, 2010), to provide the student with situations where they can take a position (Felton and Kuhn, 2001, Kuhn and Udell, 2003, Morrow et al, 2011).

I would argue that the design of effective questions not only scaffolds students' dialogue but also helps in forming the sequence of the turn-taking system in online chats as well. Sack et al

(1974) state that “a model of turn taking in conversation will be characterized as locally managed, party-administered, interactionally controlled, and sensitive to recipient design” (p.696). The turn-taking system, in turn, formulates the entire conversations structure (Sidnell, 2010). However, we have to bear in mind the difference between casual conversation and institutional conversation. Institutional conversation (as it occurs in online chat) refers to any conversation shaped by “(1) participants’ orientation to a goal, task or identity, (2) special and particular constraints, and (3) frameworks and procedures that are particular to specific institutional contexts” (Drew and Heritage, 1992, p.22).This point will be explained in more detail in section *5.3 Discussion of the findings*.

Turn-taking Analysis

While educational exchange structure and turns sequence of questions and answers inside the classroom was described by Sinclair and Coulthard (1975) as Initiating (I) turn followed by Responding (R) turn and finally optional F (Feedback) turn [I R <F>], the analysis of the students’ online chats shows how the organisation of turn-taking was governed by different type of questions or contributions.

I-R	I-R –RC (acknowledgment)	I-R-RC (Feedback and evaluation)	I-R-RI
79%	7.6%	6.4%	7%

Table 27: Type of turn-taking in 13 online sessions

Table 27 illustrates four different types of turn-taking mechanisms which occurred in online chats. First, some contributions or questions required only answers to end the exchange. The [I-R] type constituted a high proportion with 79% compared to the other types of turn-taking order. This type of exchange can be described as an asymmetrical initiative when one participant (most of the time the manager of the online chat) was consistently active by Initiating (I) while the other participants were passive by mainly Responding (R). *Example 27* extracted from the online chat, illustrates the [I-R] type.

SAR: who do you use CMC types with?	I
NOR: Emails with work colleagues, and at uni with tutors mainly	R
REN: Mostly with friends and family!	R

Example 27: [I-R] turn-taking

The second type [I-R-RC acknowledgment] accounted for 7.6% which can be identified when RC turns do not carry any validation or correctness of the response but rather they are filled by acknowledgments and show the intention to close the current exchange.

TUR: are theyre any dictionaries for lower level learners?	I
HOO http://www.wordsmyth.net/	R
TUR: Thanks HOO	RC

Example 28: [I-R-RC acknowledgment] turn-taking

In addition, the results suggest that students were reluctant to evaluate or to give feedback as the [I-R-RC Feedback or Evaluation] represented 6.4%. The extracted text from the online chat, gives example of the [I-R-RC Feedback or Evaluation] type.

BAE: How does your evaluation of the sites relate to Cunningsworth and Kapoun's criteria?	I
KHA: In my mind, different criteria should be used to evaluate different kinds of websites.	R
LOR:@KHA That's a very valid point.	RC

Example 29: [I-R-RC Feedback or Evaluation] turn-taking

The fourth type, [I-R-RI], is a more interesting case as it could be indicative of the student's engagement in argumentations. According to Pilkington (1999), we can use RI to identify a situation where argumentation takes place because "it is reserved for clarification, checking and challenging style inquiries or negotiation followed by justification, typical of repair work of critiquing" (p.8). The example below, quoted from the online chat, illustrates the [I-R-RI] type.

HOO: Which of the Malay sites did you prefer?	I
ASE:I prefered the youtube video	R
HOO:Why did you prefer the YouTube?	RI

Example 30: [I-R-RI] turn-taking

RI can also, for instance, describe the situations where reasonable answers or responses including evaluation cannot be given without additional questions for clarification (Pilkington, 1999). Clarifying moves refers to any moves that request more information and clarification of a previous turn such as "*what do you mean by* …" while challenging moves such as "*why*?" and "*why not*?" are usually followed by justification, e.g. "*yes but*" and "*no because*" (Kneser et al, 2001). As *Table 27* shows, this type of exchange accounted for 7%.

It can be said that this type of turn-taking mechanism and exchange structure could show 'reflective thinking'. Dewey (1910) defines CT as "active persistent and careful consideration of a belief or supposed form of knowledge in the light of the grounds (reasons) which support it and the further conclusion to which it tends" (p.6). Dewey describes CT as 'reflective thinking', as opposed to 'unreflective thinking' in which conclusions are reached without proper consideration of the matter at hand (Fisher, 2001). The following chapter, chapter 6, will explain how we can plan the expansion of exchange structure in order to achieve this goal of 'reflective thinking'. However, a high level of RI does not always indicate that students are engaging in repair work such as critiquing and clarifying but rather moves level analysis has to be taken into account as well (Kneser et al, 2001).

Moves Analysis

The analysis of students' moves suggests that students were not engaging in exploratory discourse but rather cumulative discourse. Exploratory discourse occurs when students are actively engaged in critical and constructive dialogue where the justification of their challenged ideas is articulated (Mercer, 1995). Cumulative discourse takes place when students accept and agree with their peers' contributions in an uncritical manner, and can be characterised by the lack of careful evaluations and reasonable judgment of their peers' ideas (ibid). "Cumulative talk characterizes dialogue in which ideas and information are shared and joint decisions are made: but there is little in the way of challenge or the constructive conflict of ideas in the process of constructing knowledge" (Mercer and Littleton, 2007, p.54). This conclusion is supported by the fact that students were reading each other's contributions (ill-formed I-I turns=0, see *Table 23*), and the large number of *Agree* and *Accept* moves which accounted for 9.3% (total 233+31=264 moves, see *Table 28*) compared to *Disagree and justification* moves that represented 0.5% (total 15 moves), see *Table 30*. An ill-formed (I-I) turn occurs when a contribution is an island, with no response to it.

Sessions	Moves	Inform	Accept	Reason	Agree	Acknowledgment
	ESA	R	R	R	R	RC
U4AFR1		120	1	13	24	17
U4AFR2		91	3	14	12	17
U4EVR1		110	0	22	13	11
U4EVR2		106	2	21	26	8
U5AFR1		109	4	14	12	11
U5AFR2		113	0	25	13	11
U5EVR1		127	6	26	29	17
U5EVR2		64	0	11	4	8
U5EVR3		98	1	20	23	14
U6AFR1		133	5	12	41	30
U6EVR1		93	0	11	1	13
U6EVR2		65	3	6	9	16
U6EVR3		116	6	12	26	43
Total		1345	31	207	233	216
Percentage		47.8%	1.1%	7.3%	8.2%	7.6%

Table 28: The overall passive moves in 13 online chats

Note that, the explanations and examples of the abbreviations and terms mentioned in *Table 28* are illustrated in Chapter 4 (Section Discount scheme)

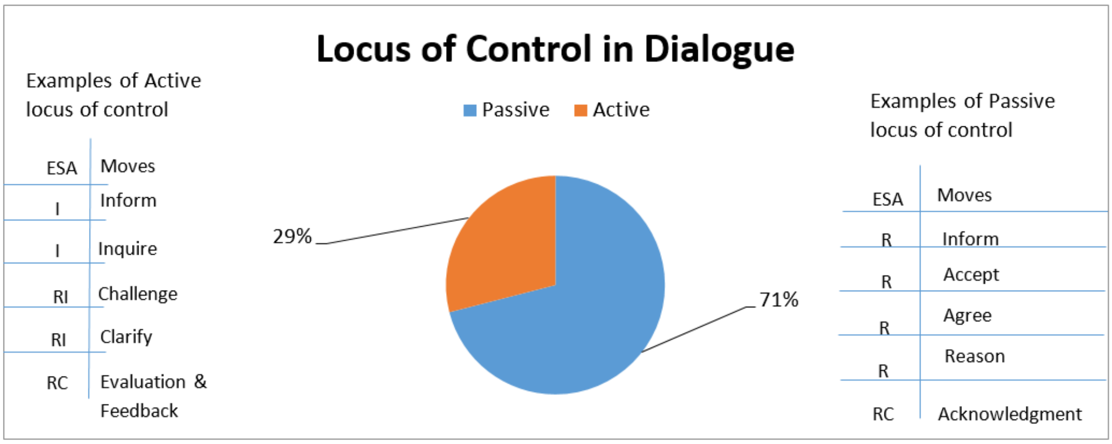


Figure 21: Locus of Control in Dialogue

Table 28 & *Figure 21* illustrate that students' passive locus of control represented a high rate (71%) compared to their active locus of control that constituted only 29%. These findings suggest that students in online chats did not adopt the argument roles that could be signs of exploratory talk. Locus of control refers to the level at which participants in online seminars were either adopting active roles of argument (initiator, re-initiator, or evaluator) or passive roles (responder) (Kneser et al, 2001).

It could be said that because of the 'preallocated' turn-taking order (Sack et al, 1974, Atkinson and Drew, 1979, Drew and Heritage, 1992) and the nature of multiparty discourse in online chat, passive *Inform* moves represented a high proportion with 47.8 % (total 1345 moves, see *Table 28*). The preallocation turn-taking type occurs during the activities of asking and answering questions in institutional settings (Drew and Heritage, 1992, Clayman and Heritage, 2002), typically when one party has a predetermined role over the other participants (Heritage, 2005, Freed and Ehrlich, 2009) (see chapter 3, section *3.2 Turn-Taking)*. I would argue that the turn-taking order in students' online seminars could be described as partially preallocated turn-taking. From my experience as a student who studied the same course I would say that, during the online seminars, students were waiting for the online manager until she/he posted the predesigned questions. Before initiating a new exchange, students' participations were implicitly based on the assumptions that the 'chairperson' or the online managers are the ones supposed to initiate the new exchanges by asking the tutor's list of questions. The mechanism of turn-taking or turn-taking behaviours is shaped by the context (Sidnell and Stivers, 2012).

However, the active *Inquire* moves accounted for 8.8 % (total 248 moves see *Table 30*) which were mostly initiated by the managers of the online sessions (see *Table 29*).

Session	Managers	Inquire moves	Overall inquire moves	% of Total
U4AFR1	NIV	11	19	57.8%
U4AFR2	SAR	11	19	57.8%
U4EVR1	BAE	8	16	50%
U4EVR2	KHA	15	20	75%
U5AFR1	REN	10	18	55.5%
U5AFR2	HOO	11	18	61.1%
U5EVR1	AMA	10	15	66.6%
U5EVR2	ARJ	17	20	85%
U5EVR3	BAE	12	17	70%
U6AFR1	NIV	8	20	40%
U6EVR1	FAI	9	20	45%
U6EVR2	AMA	15	17	88.2%
U6EVR3	NAS	20	28	71.4%

Table 29: The overall Managers' Inquire moves in 13 online chats

As shown in *Table 29*, the tutor successfully transferred the control of the chat sessions to students, supported by the constructivists' approach to learning (Kiraly, 2001, Khine and Fisher, 2003, Martin and Loomis, 2013). Yet, the results suggest that students were not able to create a constructive conflict and pose critical questions to detect fallacies in argument. As a result of these deficiencies in students' skills, they were not capable of maintaining the development of their argumentation. These skills are essential for academic argumentation and have to be given a very important consideration (Kuhn et al, 1997, Walton, 2007, Browne and Keeley, 2007, Andrews, 2010). As we can see in *Table 30* the analysis of the chats uncovers the lack of students' skills and abilities of argumentation as *challenge* moves amounted to only 0.67%. *Challenge* moves occur when students ask questions to their peers to produce a defence or justification of a line of argument.

It can be said that students' dialogue in online chats can be described as an asymmetrical collaborative building dialogue rather than symmetrical collaborative and constructive critiquing. "We may have patterns of exchange in which one participant acts as a principal inquirer whilst the other acts as a principal responder in an asymmetrical knowledge-building phase" (Pilkington, 1999, p.18). The findings also showed a low rate of role swapping (indicated by initiative swap in *Table 30*) that constituted only 3.5 % (total 85). Initiative swaps occur when a student switches from answering a question (Responding) to asking a new one (Initiating) or (Reinitiating) within the same turn. A high number of initiative swaps that happen during a chat among participants could reflect their active engagement of argument and vice versa.

When exploring further the low level of the initiative swap roles, which is 3.5 % of the total, we can notice that the managers of the chat held the highest rate with 36% while all the other participants shared 52%. This finding suggests that the managers tended to take the initiative back from the other participants to maintain the active role so that he/she can continue to ask pre-designed questions.

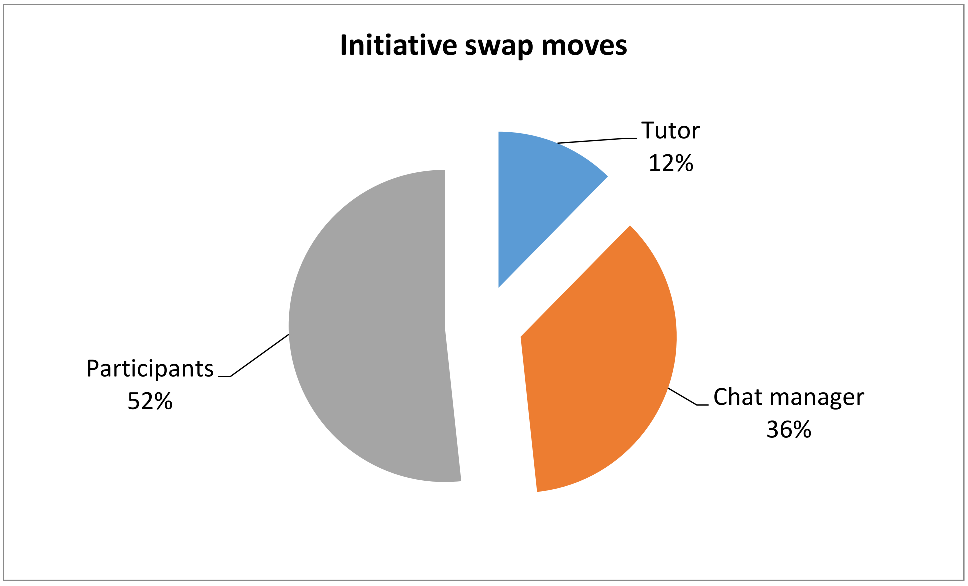


Figure 22: Initiative swap moves in 13 online chats

Sessions	Moves	Inquire	Inform	Reason	Feed-back	Challenge	Check	Clarify	Disagree+ Justification	Initiative swap
	ESA	I	I	I	RC	RI	RI	RI	RI	R+I & R+RI
U4AFR1		19	16	1	8	0	0	16	5	10
U4AFR2		19	12	0	13	1	1	10	1	6
U4EVR1		16	32	1	12	1	6	6	0	12
U4EVR2		20	11	0	8	2	1	8	5	7
U5AFR1		18	12	2	12	4	2	15	2	10
U5AFR2		18	10	0	4	2	2	13	2	11
U5EVR1		16	12	0	8	3	2	6	0	3
U5EVR2		20	5	0	2	3	1	6	0	2
U5EVR3		17	5	0	10	3	2	5	0	5
U6AFR1		20	26	0	16	0	4	4	0	8
U6EVR1		20	13	0	5	0	4	2	0	6
U6EVR2		17	11	0	5	0	4	3	0	3
U6EVR3		28	18	0	8	0	2	4	0	2
Total		248	183	4	111	19	31	98	15	85
Percentage		8.8%	6.5%	0.01%	3.9%	0.67%	1.1%	3.4%	0.5%	3.5%

Table 30: The overall Active moves in 13 online chats

Note that, the explanations and examples of the abbreviations and terms mentioned in Table 8 are illustrated in Chapter 4 (section *Discount scheme*)

However, although we could find some *challenge* moves which took place, they were 'premeditated'. I call them premeditated because they were pre-planned by tutors. To support my claim, the analysis of *challenge* moves that happened during the online chats was further divided into two sections: (1) student-posed questions, (2) tutor- pre-planned questions. A student-posed question refers to a question posed by a student during the chat and was not included in the list of questions prepared in advance by the teacher. By conducting this analytical step, we can explore the accurate level of students' critiquing (*challenge* moves) which took place during the chats. The following examples illustrate these two sections:

(1) A student-posed question:

REN : Yes I have but what I would like to note is that even though it looks professional there are still some activities that for my own perspective are not appropriate!

NOR :Why not REN?

Example 31: Student-posed questions

(2) A tutor- pre-planned question:

REN: With regard to the dictionaries on the notes, which one do you prefer and why??

Example 32: Tutor- pre-planned questions

In the second example, the posed questions by the manager of the chat (REN) were based on the tutor's predesigned questions. The findings revealed that the *challenge* moves made during the chat were often drawn from the lists of reflection questions that were predesigned by tutors for discussion in the chat seminar. As we can see *Figure 23* illustrates that the *challenge* move drawn from the tutors' list of questions accounted for 68%, while the challenge moves made by students during online chat constituted only 32 %.

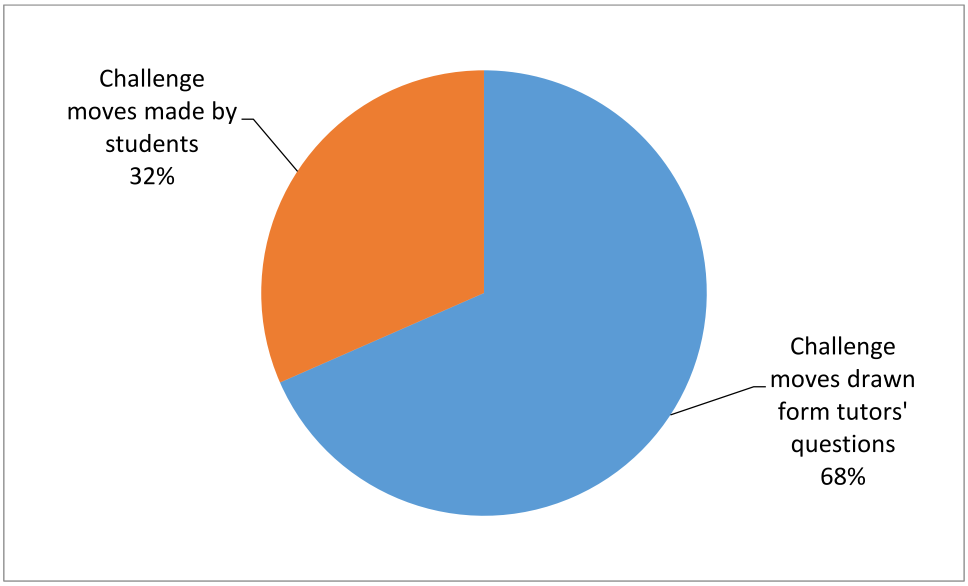


Figure 23: Students and tutors' challenge moves made during the 13 online chats

As shown in *Table 31*, the session U6AFR1, did not contain any *challenge* moves because of the fact that tutors' list of question did not include any challenging questions.

Moves	ESA category	TUR	NIV	NOR	REN	SUL	KHA
Inquire	I	5	8	4	0	1	2
Inform	I	3	5	11	2	4	1
Reason	I	0	0	0	0	0	0
Feedback	RC	0	4	4	5	3	0
Challenge	RI	0	0	0	0	0	0
Check	RI	0	1	2	0	1	0
Clarify	RI	0	1	2	0	1	0
Disagree + Justification	RI	0	0	0	0	0	0

Table 31: The overall Active moves in U6AFR1 session

In addition, when the exploration of *challenge* moves is taken further, the results suggest that these moves were preceded by the probing of standpoints, perspectives, assumptions or conclusion. According to Pilkington (1999), a *Probe* function takes place when you "ask questions of the learner to elicit a relevant fact or operator" (p.13). Probing can be realized by a single move or a sequence of moves performed during the chat. The examples below illustrate some of the tutors' pre-designed questions that showed a probe function followed by challenge moves. These tutor-posed questions were embedded within the list of questions prepared by the tutor prior to the chats. These sorts of questions play crucial roles in scaffolding students' discussions and are mostly the base of *challenge* moves:

- Does using text chat help students develop the language they are learning? If so, how?
- Which of the dictionary sites did you prefer and why?
- Which of the Malay language sites did you prefer and why? What criteria did you use to evaluate the websites?

These questions prompted students to state their positions and encouraged them to provide supporting reasons for their points of view (Rieke and Sillars, 1984, Reznitskaya et al, 2001, Kuhn and Udell, 2003). However, in order to help students to argue constructively and productively, we cannot rely only on fixed and rigid questions prepared in advance. The argumentation process requires some sort of instant analysis and evaluation of preceding turns (Walton, 2007 and 2015, Fischer and Gottweis, 2012). Asking the right questions at the right moments leads effectively to developing the sequence of exchange and the argumentation process (Blair and Tindale, 2011, Chinn and Clark 2013). The analysis of the students' chat transcripts showed that students were unwilling to state their reasons or supporting evidence and they preferred to take passive explainer roles (passive *reason* moves accounted for 7.3 %, see *Table 28*) instead of active explainer roles (active *reason* moves represented 0.01%, see

Table 30). As a result of the passive explainer roles adopted by students and the reliance almost on the pre-set list of questions, students' chats contained some participations not clearly articulated, assertions and unsupported claims or conclusions. For example,

HOO: I don't think using text chat help students develop the language they are learning… in fact, i think it can damage it
NAE: I wonder if using text chat helps with oral fluency in any way?
HOO: probably not spelling and definitely not pronunciation.

LOR: I think games can be a good way to learn a language.
AMA: I think many students like that kind of game, but I don't think they really like learning language, just for playing games.

ANA: because i do not agree personally
ANA: i mean it might help to some degree but not a effective way.

Example 33: Assertions and unsupported claims/conclusions occurred during online chats

The low level of both the clarifying role during the online chat (indicated by the *clarify* moves that only constituted 3.4%, see *Table 30*) and the critiquing role (suggested by *challenge* moves that represented only 0.67%, see *Table 30*), might suggest the limitations of peer managing and highlight their low abilities to scaffold students' discussion. As the findings revealed, students did not show tendencies toward the intellectual behaviour of the argument role, such as the desire to be well-informed, look for alternatives, and seek reasons (Tishman and Andrade, 1995, Moore, 2011, Lia, 2011, Ennis, 1985).

I would argue that we cannot expect students to adopt these important behaviours of argumentation without being trained and exercised to do so (Tishman and Andrade, 1995, Reznitskaya et al, 2009). It might be said that we have to consider different factors that could affect students' contributions in the chats. For example, students' participations could be affected by their proficiency and confidence in English language (Warschauer, 1996b, Kneser et al, 2001, Lim and Sudweeks, 2008b, Zhang and Kenny 2010) as the majority of the participants in online seminars were overseas students (20 students), who speak English as a second language. If that was the case, then it is one of the potential advantages of Botocrates because such students feel more comfortable when chatting with chatbots (Fryer and Carpenter, 2006, Savin-Baden et al, 2015).

5.3 Discussion of findings

This section illustrates the interpretations of the findings presented in the previous section with the aim of finding out the answers to the research question of this phase of the research: what should go into Botocrates' brain? The implications of the findings above on Botocrates' prototype will be explored in more detail.

The Generation of the Argument

As we noticed, students relied most of the time on the list of questions prepared previously by the tutor. During online chats, students were not independently capable of starting the argument without the prompting of the tutor. It could be claimed that students need further assistance to be engaged in a productive dialogue that can be described as an argument. The tutor should pay more attention to scaffolding students' learning in order to shift students' dialogue towards a new cognitive territory (Cakir, 2008, Chin and Osborne, 2010b). According to Andrews (2010), identifying the point of dispute is an essential element to begin an argument. The points to be identified require knowing the territory and area of a specific discipline through reading, exploration and reflection (ibid). Once these points have been identified, we can ask students to elicit their own standpoints and perspectives. As the findings revealed, the tutor's list of questions included some questions that could prompt students to state their points of view about issues. Elder and Paul (1998) argue that our thinking is driven by well-designed questions. The well-prepared questions could help students to generate their own questions so that their thinking can go deeper (ibid). This result suggests that probing students' standpoints, perspectives, assumptions and conclusions can be seen as a key factor to start argumentation. Kuhn (2009a) claims that by asking probing questions we scaffold students' articulation of their positions about a particular topic. Chin and Osborne (2010) highlight the importance of the *epistemic probe* to establish collaborative argumentations. The *epistemic probe* refers to "the capacity of questions to ask how we know what we know" (Chin and Osborne 2010a, p.884).

I would argue that the process of probing perspectives and points of view is supported by both dialogic and dialectical approaches. Bakhtin's dialogic approach which is consistent with Vygotsky's theory of thinking suggests that our thinking and learning during a dialogue are mediated by the perspectives of others (Wegerif, 2007 and 2013, Pilkington, 2015). In addition, the dialectical thinking approach emphasises the need to confront students' with different points of view that might lead them to recognise the contradiction between their perspective and the others (Peng and Nisbett, 2000, Douglas, 2013), which in turn provokes them to be engaged in rational arguments within a reasoned community of inquiry (Ravenscroft et al, 2008).

As *Figure 24* shows, the main action of Botocrates for starting argumentation is to encourage users to state their standpoints about a specific issue related to the domain of knowledge. The starting point of argumentation should be integrated in Botocrates' brain. The aim of identifying and integrating these cognitive territories into Botocrates' brain is to plant a seed of the argumentation process in a new exchange structure. Probing users' standpoints and perspectives will allow these seeds of argumentation to grow constructively. However, as for any plant, argumentation requires a better environment for better growth.

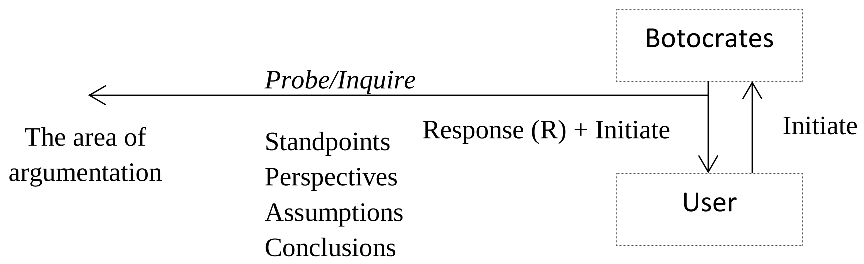


Figure 24: Botocrates' strategies for generating argument

Note that, the practical process of Botocrates' strategies are illustrated with examples in Chapter 6

Taking a Position

The analysis showed clear evidence of the preference of passive exchange roles amongst students in the online chats. The consequences of both adopting passive roles of argument and the reliance on limited and specific questions prevented students from arguing to learn. According to Andrews (2010), each stage of the argumentation process has different needs and requirements. There is a need to raise critical questions compatible with the argument scheme (Walton and Reed 2002, Walton, 2007). Students should be confronted with the right questions at the right moment (Veerman et al, 2002, Zirbel, 2006, Chin and Osborne, 2010b). Probing students' perspectives will not necessarily be followed by clearly articulated positions. The limitations of peer managing and the deficiencies of online managers' abilities are very obvious in connection with encouraging students to clarify and clearly articulate their participations. Clarifying roles represented a very low level in the chats and the initiative swap roles that were often dominated by the dialogue managers were not intended to encourage clarifications, but the aim of these moves was only to hold the floor of the conversations back in order to complete asking the tutor's pre-prepared list of questions.

Although the tutor's questions contained some that were challenging, the clarification and negotiation of students' meanings during the online chat were very important in order to promote argumentative and collaborative interactions (Baker, 2009, Andriessen et al, 2013). Before challenging students' positions by posting a pre-set order of '*why*' questions, we have to ensure that students fulfil the commitment of probe moves (Van Eemeren et al, 2007, Grewendorf and Meggle, 2012). We have to give more consideration to a situation where student's utterances need further clarification to be understood (Tsui, 1994, Sidnell, 2010). Better clarification and articulation of students' utterances and expressions could lead to better reconstruction and evaluation of students' positions (Carrick and Finsen, 1997, Lepore and Cumming, 2012). As *Figure 25* illustrates, Botocrates should be prepared to deal with different scenarios. Note that, Botocrates must also be prepared to deal with any unrelated initiating turns.

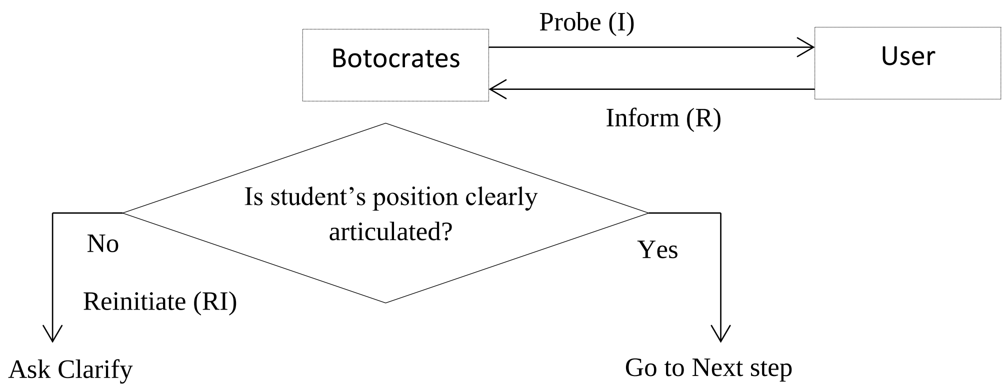


Figure 25: Botocrates' strategies for ensuring better articulation of a certain position

Note that, the practical process of Botocrates' strategies are illustrated with examples in Chapter 6

However, we might find some situations where students are reluctant to state their positions. It could be said that one of the reasons that prevents students from being engaged in argumentation and stating their opinions about a particular topic or questions is the lack of sufficient knowledge domain (Stein and Miller, 1991, Andrews, 2010, Chinn and Clark 2013). Students' competencies, experiences and subject-specific knowledge are essential elements that need to be taken into account before asking learners to engage in argument (Aufschnaiter et al, 2008). Students should support their claims or positions with evidence that could be inspired by means of the learning materials or the suggested reading lists (Cornelius et al, 2013). “Knowledge of the discipline one is studying affects people’s abilities to monitor their own understanding and evaluate others’ claims effectively” (Donovan and Bransford, 2005 p.12). Chinn and Clark (2013) claim that constructive and productive collaborative argumentation is unlikely to occur without sufficient background knowledge. Pilkington and Walker (2003a) suggest that we can bridge the gap between students’ lack of domain knowledge and the information needed to be engaged in argumentation by providing information during the chat spontaneously or when replying to students’ questions.

Active and passive explainer roles

As the findings showed, participants in online chats had a tendency to not state their reasons or supporting evidence unless they were challenged to do so. They preferred to adopt passive explainer roles rather than active explainer roles. In this respect, I would like to introduce the new concepts: a) ‘*challenge to explain*’, and b) ‘*explain to challenge*’. I believe that we have to understand the differences between these concepts in order to shift students from being passive to active explainers. On the one hand, *challenge to explain* refers to a situation in which a reason or supporting evidence is given and stated as a response to the other’s explicit question and challenge move. In such a situation, the explainer tries to defend her/his claim or conclusion against the raised questions due to the explicit doubt of other parties in the dialogue about the final conclusion. This kind of circumstance might show a minimal structure of argumentation as reflective thinking, or a careful consideration and evaluation of a conclusion or a claim that is based on a given reason (Fisher, 2001, Govier, 2009, Crosswhite, 2012). Challenging claims and assertions during a dialogue could enable students to also uncover fallacies in any undisciplined reasoning (Damer, 2008, Luckhardt and Bechtel, 2014, Walton, 2015a).

During students’ online chats, if the stated claims were not followed by *challenge* moves, the assertions of participants would not develop to argumentation. Developing an assertion into an argument requires a mutual conflict where the assertion is challenged and questioned (Crosswhite, 2012). Challenging students’ ideas or opinions in the online seminars was mostly the responsibility of the online managers who, in turn, were merely posting the tutor’s pre-designed questions. Although the tutors succeeded in embedding some limited challenging questions in their pre-designed list of questions, more consideration and attention should be given. Therefore, it is not surprising to find assertions and unsupported claims in students’ contributions in online chats. Students are not capable of creating this kind of constructive conflict required for productive argumentation (Mercer and Littleton, 2007, Long et al, 2010, Littleton and Howe, 2010). The absence of such meaningful conflict could contribute to the absence of reasoning (Bickenbach and Davies, 1996, Cottrell, 2011).

On the other hand, '*explain to challenge*' refers to a situation in the argumentation process in which a claim or a conclusion is followed by a reason as a result of an implicit question and challenge raised by the same interlocutor. "If a claim were not questioned or challenged in some way, there would be no need to offer a reason to support it" (Crosswhite, 2012, p.78). The implicit question in this situation aims to challenge any doubts that could be raised against the position taken. Reasoning and explanation in an argumentation process may achieve the 'transfer of understanding' from the interlocutor to others, or could be refuted (Walton, 2015a, p.98). The interlocutor in such a situation wants to convince other parties in the dialogue (Walton, 2006).

> Why should one ever have to give a reason to support a claim? One might have to give a reason because the claim is open to doubt. This observation implies that there are always two sides to an argument, and thus that an argument takes the form of a dialogue. On the one side, the argument is put forward as a reason in support of claim. On the other side, that claim is seen as open to doubt, and the reason for giving the reason is to remove that doubt.
>
> (Walton, 2006, p.1)

In academic argumentation, considering alternative positions and explaining the position taken by stating a well-disciplined reason is seen as one of the most important skills (Andrews, 2010, Carroll, 2013). When practicing '*explain to challenge*', we are implicitly considering and acknowledging different positions and defending our position or claims explicitly against alternative positions. Here, I would call the process *implicit self-challenge* rather than *explicit co-challenge*. Such a cognitive process can be described as the fruit of developing metacognitive and critical thinking skills including self-reflection (Mcgregor, 2007, Tarricone, 2011, Benton, 2014).

I believe that engaging students constantly in the '*challenge to explain*' practice could lead to a significant change towards adopting the intellectual behaviour of the '*explain to challenge*' process. My claim is supported by both Vygotsky's theory of internalisation and Piaget's theory of cognitive development. Vygotsky's theory of internalisation suggests that, when someone interacts with the other party in a dialogue, she/he "actively reconstructs external and shared operations on the internal plane” (Fernyhough, 2008, p.227). Vygotsky’s notion highlights the link between our social interactions and our cognitive development, because according to Vygotsky, humans use tools that develop from a culture, such as discourse and writing, to mediate their social interactions (Riddle, 1999). Vygotsky suggests that the internalisation of these tools leads to higher thinking skills (ibid). While any assertion in the *‘challenge to explain’* process can be developed into argumentation as a result of the mutual conflict within ‘external, shared operations’, the assertion in ‘*explain to challenge*’ is reconstructed and developed into argumentation within the ‘internal plan’ of the interlocutor. In mutual constructive conflict, the failure to accomplish the commitment and the condition of taking a position facilitates the occurrence of argumentation (Van Eemeren et al, 2007, Grewendorf and Meggle, 2012).The internalisation of tools used to satisfy the condition of the taken position leads students to fulfil the precondition by stating and clearly articulating a valid reason and supporting evidence.

Furthermore, based on Piaget’s theory of cognitive development, Woolfolk (2005) argues that when people are born, they have a tendency to structure their thought processes in a psychological manner, and this is the foundation for our abilities to understand and interact with the world. Humans have a tendency to adapt to the environment/context in which they are placed, and two key processes are involved in adaptation: assimilation and accommodation (ibid). It could be said that the assimilation of the process of *‘challenge to explain*’ evokes the new accommodation, by subconsciously recalling the process of ‘*explain to challenge*’. Extensive research has confirmed the importance of students’ prior experiences and practices for developing a conceptual change and improving critical thinking and argumentation skills (Ravenscroft and Pilkington, 2000, Kuhn et al, 1997, Wegerif and Mercer, 1997, Mercer, 2000, 2003 and 2008, Pilkington and Walker, 2003a, Ravenscroft and McAlister, 2006a, Ravenscroft, 2007). Prior experiences and practices are the key to developing intellectual abilities and skills which can be defined as the aptitude of individuals to discover suitable information and methods in their previous experience and exploit them either to solve new problems or to bring to bear into new situations (Bloom, 1956a).

In the light of the argument above, it could be argued that ‘*explain to challenge*’ can be seen as an outcome of the continuous practice of ‘*challenge to explain*’. Unfortunately, as we noticed, the very low level of both students’ challenging moves and critical questions in online chat suggests that this practice is far from reaching the desired outcomes.

Constructive disagreement

As the findings suggest, students in online chats were not practising dialectical and exploratory talk. Engaging in exploratory talks requires a certain degree of meaningful disagreement or contradiction where the justifications are articulated (Mercer and Littleton, 2007, Mercer, 2008). The reason behind their uncritical agreements could result from the lack of counter evidence and reason that undermine their initial agreements (Lau, 2011). One of the ways to reduce the high rate of uncritical agreement between participants in online chats, in order to shift them into constructive disagreement, is to open and raise any hidden and related issues (Brook, 2008). Substantive conflict takes place when alternative standpoints or points of view are raised (Phye, 1997, Pilkington and Walker, 2003a). The aim is to create 'discrepancy' among students' perspectives in online chats which leads to establishing such a meaningful conflict (Kuhn et al, 1997). The key element to stimulating thinking itself has a certain degree of contradiction, since absolute consensus is 'nothing but a dogma' and an 'absolute contradiction' that 'leads us nowhere' (Singh, 2000, p.262). Peng and Nisbett (2000) state that "the key feature of dialectical thinking is integration, starting with the recognition of contradiction, then moving on to the reconciliation of basic elements of the opposing perspectives" (p.742)

This type of constructive conflict, which includes substantive conflicts, could be in the form of counter-argument. Encouraging students in online chats to give a consideration to counter-arguments is as important as raising critical questions (Walton, 2009). Counter-arguments could inspire students to rethink their positions and move from simple agreement to better evaluation of both sides of an argument (Cottrell, 2011, Nickerson, 2013). Integrating counter-argument in collaborative argumentation can help students to modify and reconstruct their initial conclusion in the face of raised and unconsidered issues (Wade, 2009, Felton et al, 2015). Tutors who facilitate online collaborative interactions can maximise the potential of students' engagement in argumentation by planning the occurrence of the counter-argument within the argumentation sequence (Stegmann et al, 2007, Clark et al, 2010, Kopp and Mandl, 2012). As I explained in the section *The Generation of the Argument,* identifying the area of dispute enables online chat facilitators to find the area where different positions can be taken and where argument and counter-argument could be raised. However,

> This is a matter of knowing the territory of the discipline, or at least of the topic. Once that territory is traversed via wide reading, reflection, discussion,

> and exploration of primary and secondary sources, the points of dispute tend to emerge.
>
> (Andrews, 2010, p.82)

Planning the expansion of exchange structure

The findings of the analysis clearly demonstrate the impacts of tutors' questions, which were prepared prior to the discussions, on the mechanism of turn-taking and the final exchange structures. As noticed, most of the effective moves that could indicate the structure of argumentation were centered on the fourth type of turn- taking [I-R-RI]. It could be said that understanding the mechanism of turn-taking and focusing on building the fourth type of turn-taking [I-R-RI] could help online chat facilitators to promote students' engagement in argumentation. In order to explain the process of building the fourth type, I would like to propose the notion of the *constructive expansion of exchange structure*. In dialogues, there are some circumstances where the second pair part is not accepted and preferred which can cause disagreements or misunderstandings between speakers which, in turn, lead to the expansions of adjacency pairs (Levinson, 1983, Schegloff, 2007). The consecutive expansion of adjacency pairs can be seen as an argumentation process that attempts to solve the disagreement between speakers (Jackson and Jacobs, 1992, Gruyter, 1987, Putnam and Roloff, 1992, Fetzer and Meierkord, 2002).

> A basic constructional unit for producing organized conversation is the adjacency pairs. These pragmatically related pairs of speech acts not only produce sequentially implicated turns, but also provide for structural expansion into broader patterns of turns organized with relevance to dominant adjacency pairs.
>
> (Jackson and Jacobs, 1992, p.682)

Here I want to shift the focus from casual conversations to educational ones. In other words, I want to shift the focus from the adjacency pairs to the 'broader patterns' constituting our educational talks which are represented within the entire exchange structure (Sinclair and Coulthard, 1975). This implicates shifting the attention from a naive disagreement to a purposeful and planned 'disagreement' within a teaching exchange. A teaching exchange refers to specific steps by which the activity progresses by means of some moves (ibid). Coulthard and Brazil (1992) define an exchange as "the unit concerned with negotiating the transmission of information" (p.74).

Online facilitators should not rely mostly on types of questions that generate the [I-R] type. It could be argued that the reliance mainly on these sorts of questions has a negative impact on students' chats. Students are not expected to be engaged in symmetrical collaborative and constructive critiquing during these types of question, because the online managers were the main initiators and the others were responders (Pilkington, 1999). The [I-R] type can be seen in the lowest level of Bloom's Taxonomy (1956a) which is Knowledge, by which students can remember, either by recalling or recognising ideas and materials. When online facilitators design such questions, students' only recall facts about the topic being discussed without a meaningful critical reflection (Oermann and Gaberson, 2013, Simmons, 2015). In order to develop students' intellectual abilities and skills, we should focus on questions requiring higher level thinking (Moore and Stanley, 2010, Brown, 2004, Hopper, 2011, Oermann and Gaberson, 2013).

The *constructive expansion of the exchange structure* can be planned and implemented by a sequence of questions within the same exchange. When questions are being developed within the same exchange structure, constructive conflict could increase, which contributes to the improvement in students' cognitive abilities (Heydenberk et al, 2000, Myers, 2012, Rhoder and French, 2012). Planning the *constructive expansion of the exchange structure* can be understood when we see the argument as a tree. The first step of the expansion is planting the seed of argumentation. The growth of this seed occurs when we probe students' perspectives and encourage them to clarify their ideas. Furthermore, challenging students' ideas by raising critical questions and encouraging them to consider any counter- arguments could contribute to the *constructive expansion of the exchange structure*. Within the expansion assertions should be developed into arguments and fallacies detected. The *constructive expansion of an exchange structure* could lead students to:

- Taking a position and clearly articulate standpoint.
- Supporting a claim or conclusion by stating well-disciplined reasons.
- Avoiding an assertion without evidence.
- Avoiding fallacies of argument.
- Considering any counter-argument.
- Defending the taken position against any counter-argument or any counter evidence.

However, a fruitful expansion of an exchange structure requires the presence of "a role-model to scaffold students' interactions" (Kneser et al, 2001). Also, the role model should focus on keeping the argumentation process on the right track that leads to the expansion. Keeping argumentation on the right path encompasses encouraging students' to fulfil the commitments of any preceding moves (Van Eemeren et al, 2007, Grewendorf and Meggle, 2012). In addition, we should maintain the focus on the present and current exchange structure (Walton, 2004 and 2005). The supportive scaffolding process requires the tutor to guide and model the ideal roles, and then fade from the discussion so that the internalisation of such roles can be achieved (Jackson et al, 1998, Kneser et al, 2001, Pilkington and Walker 2003).

5.4 Conclusion

The aim of the analysis and the discussion presented in this chapter is to help in identifying some of the characteristics and the features of Botocrates' intellectual behaviours that could lead to promoting students' critical thinking and academic argumentation skills. The analysis was conducted at different levels: exchange structure, turn-taking and conversational moves. The analysis of exchange structure explained how the active role can be modelled. Modelling the active role by responding and initiating or re-initiating within the same turn could lead Botocrates to control the flow of the dialogue. Also the findings and their interpretation suggest that students tend to adopt different conversational behaviours. The results from conversational moves analysis showed that, students' interactions in online seminars revealed a low level of adoption of argumentation roles. The discussions were, most of the time, limited to an information-exchange level. Two influencing factors could encourage students to be engaged in the argumentation process: a) the design of effective questions, and b) the level of scaffolding provided during students' interactions. These two factors are interrelated.

The design of effective questions includes both selecting the type of question and the topic of the discussion. The type of question here means shifting students from simply recalling information to probing their opinions and putting the stated positions in doubt. This process in turn helps students to be engaged in what I called the '*challenge to explain*' process. *Challenge to explain* refers to the situation of a dialogue where students' assertions are developed in argumentation as a result of explicit doubt raised by one of the interlocutors. The internalisation of such a process might help them to adopt a more active explainer role and could promote students' critical thinking and academic argumentation skills. The second factor that may affect students' engagement in the argumentation process is the topic under discussion. The topics under discussion should be carefully determined. Probing questions need to emerge from areas where different positions can be taken. Such areas of dispute create a healthy and constructive discussion that could enable students to be engaged in critical discussion (persuasive argumentation).

In addition to the new concepts ('*challenge to explain*' and '*explain to challenge*') presented in this chapter, the new technique of planning and implementing the *'constructive expansion of exchange structure*' was produced. As we can notice there are two stages that decide whether the constructive expansion can be successfully achieved or not. While the first stage '*planning the expansion*' refers to selecting the right areas where the probing questions can take place, the second stage is as important as the first one. *'Implementing the expansion'* requires Botocrates to ask the right question based on the current circumstance of the expansion. This in turn involves a dynamic process of detection and classification of student's communicative intentions.

The next chapter introduces the components of Botocrates' brain and the dialogue strategies and tactics needed for achieving Botocrates' final goal of interactions. The practical processes of dialogue and sub-dialogue that may occur when Botocrates interacts with students are illustrated with examples.

Chapter Six: Botocrates' prototype

6.1 Introduction

The aim of this chapter is to introduce the distinctive attributes of Botocrates' actions that could promote students' CT and academic argumentation skills during interactions. This chapter is an extension to chapter five where the analysis and the discussion helped in shaping the development of Botocrates' intellectual behaviours. Presenting the brain of Botocrates throughout this chapter contributes to answering the central research question of this stage of the study: 'What should go into the bot's brain that is likely to promote critical thinking and academic argumentation skills?' As we will notice in this chapter, the objectives of this phase of the research study were achieved including uncovering the characteristics of Botocrates' dialogue strategies needed for reaching the final goal. In addition, the process of dialogue and the importance of the subject-specific domain of knowledge are extensively explained. This chapter consists of six main sections. The next section, the second section, aims to illustrate and justify the new approach of Botocrates: *challenge to explain*. The purpose of the third section is to present the tasks and sub-tasks required to be performed by Botocrates during the interactions with students. This section is divided into two main sub-sections: a) first task: providing information during an information-seeking dialogue, and b) second task: engaging students in the *challenge to explain* dialogue. The fourth section shifts the attention toward the need for a machine that could perform Botocrates' approach including the tasks and the sub-tasks during the dialogue. The fifth section reveals the expected scenarios of the interaction between Botocrates and user followed by the presentations of dialogue strategies and tactics. The conclusion section is the final section which presents a brief summary of the main points discussed in this chapter.

6.2 Botocrates' approach

Any academic argumentation can be described as a persuasive one aiming at convincing audiences, examiners, readers etc. (Cioffi, 2009, Andrews, 2010, Carroll, 2013). During the process of persuasion dialogue, the proponent starts by stating a position related to a certain topic, having sufficient support that could convince others (respondents), and defending the taken position against any counter-arguments (Walton, 2006 and 2015b, Andrew, 2010). The final aim of the persuasion argument is to remove the conflict between different opinions by rationally persuading them to accept one position over the others (Walton and Krabbe, 1995, Walton, 2003). I believe that, if the aim is to promote students' critical thinking and academic argumentation skills, we need to differentiate between the three different terms related to 'academic argumentation': a) academic argument as a product, b) the academic argumentation process, and c) promoting academic argumentation skills as a process. Although these are interrelated, the first term (argument) is the outcome of the argumentation process (Keith and Rehg, 2008, Andrews, 2010, Bricker and Bell, 2011). Applying the argumentation process requires practice or a process for promoting students' skills in academic argumentation. The ability of students to be persuasive and convincing when producing an argument is a consequence of their argumentation (Van Eemeren, 2015). Both argument and the argumentation process can be seen as the final stage where the evaluation takes place. Andrews (2010) refers to argumentation as the process by which arguments can be developed.

The aim of Botocrates is to promote students' CT and academic argumentation skills. In other words, to enhance students' abilities to reach the final stage of being convincing (producing argument) and applying the process of argumentation. Increasing the quality of arguments produced by students cannot be obtained without engaging students in practice that could lead to the final goal (Benoit and Hample, 1992, Tindale, 1999, Thayer-Bacon, 2000, Freeman, 2011, Johnson, 2014).

In the process of the final stage of being persuasive in order to convince others of a position (*P*) regarding a topic (*T*), the mechanism of argumentation should take place. Let us look at *Figure 26*:

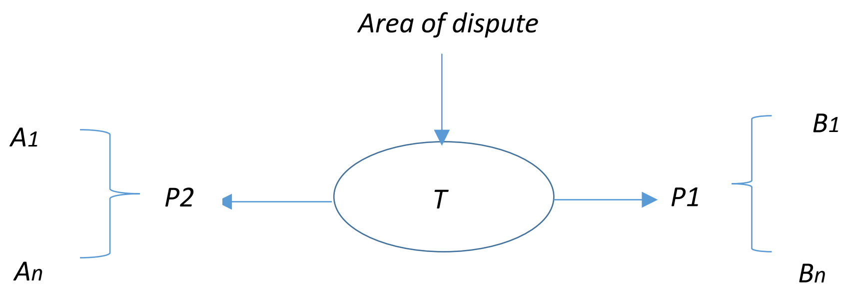


Figure 26: Nodes of positions and the sub-nodes of support

Sara wants to convince other parties in the dialogue with the validity of her position *P1* over the position *P2.* She starts by stating and asserting that *P1* is a valid position and she is aware that she needs to develop her assertion into argumentation by articulating her evidence *B1, B2,…Bn*. Sara also knows that she has to consider the alternative position *P2,* and therefore, she acknowledges the position *P2* and defends her position *P1* against the counter-argument or the position *P2* (Walton, 1998, Waicukauski et al, 2009, Bowell and Kemp, 2014). During this process, Sara is engaged in an *explain to challenge* dialogue. The *explain to challenge* dialogue refers to a type of dialogue where an assertion is developed into argumentation as a result of implicit and challenging questions raised by a particular speaker regarding a certain position.

> If a claim were not questioned or challenged in some way, there would be no need to offer a reason to support it
>
> (Crosswhite, 2012, p.78)

These implicit questions can be viewed as a part of her awareness of the process of convincing others rationally. Convincing others means, she has to deal with any doubts that could be raised (Andrews, 2010, Carroll, 2013). The aim of Sara is to challenge any doubts that might be raised against the position *P1* regarding the area of dispute *T*. During the process of *explain to challenge,* Sara was representing and considering the opinions of the other parties in her argumentation to remove their doubts. As explained in chapter five, I referred to this process as *implicit self-challenge* rather than *explicit co-challenge*, which could indicate the development of Sara's metacognitive, critical thinking, and self-reflection skills (McGregor, 2007, Tarricone, 2011, Kaplan et al, 2013, Benton, 2014).

The early differentiation that I proposed between the three terms, argument, argumentation process, and promoting argumentation skills, is important because we need to acknowledge the differences in students' abilities between the final stage (argument and argumentation process) and the stage of promoting argumentation skills. The stage of enhancing students' argumentation skills requires Botocrates to offer students situations that could help them to internalise the argumentation process (Cam, 2006, Long et al, 2010). In order to increase students' abilities in academic argumentation, Botocrates should provide them with support that could maximise their optimal levels of cognitive development (Kitchener and Fischer, 1990). Students' optimal levels could be described as "the upper limit of the person's general information-processing capacity" (Kitchener and Fischer, 1990, p.54). Promoting students' optimal levels is associated with their skills' acquisitions, which is a gradual process of reaching new cognitive abilities (Kitchener et al, 1993, Kitchener and Fischer, 1990, King and Kitchener, 1994, Tan, 2012, Arthur, 2012). Botocrates' approach is based on the assumption that continuous students' engagement in a *'challenge to explain'* dialogue could lead to enhancing students' critical thinking and academic argumentation skills. The c*hallenge to* *explain* dialogue refers to a dialogue where an assertion is developed into argumentation as a result of explicit challenging questions (section *Active and passive explainer roles*, in chapter 5, illustrates the two concepts: *challenge to explain* and *explain to challenge* in further detail).

During the *challenge to explain* dialogue, Botocrates' brain is created to expose students to different situations, in which they need to demonstrate better articulation of their produced argument (Chinn and Clark, 2013). Engaging students in the *challenge to explain* dialogue is one of the main tasks of Botocrates. The goal of Botocrates is not to accept or refute students' positions, but the main goal is to raise doubts about their positions in order to engage them in repeated and constant cycles of reflective thinking processes, that could lead to the desired outcomes (Kuhn, 1991, Walton, 1999, Walton et al, 2008, Van Eemeren et al, 2007, Van Eemeren et al, 2013). The loop of *challenge to explain* includes, probing students' opinions, asking clarification questions, challenging students to articulate their reasons and supporting evidence, detecting any potential fallacies, and confronting students with counter-arguments (note that all these sub-tasks of the *challenge to explain* approach are illustrated and justified in the next section). When students are engaged in such a process, they can evaluate and reflect upon their own arguments (the products) through the process of argumentation. This practice could help students to gauge the strength of their positions compared to others' positions (Kuhn and Udell, 2007, Andrews, 2010). Botocrates' approach highlights the importance of students' metacognitive skills, which play essential roles in developing their own thinking and adopting the new strategies of argumentation (Zohar and Dori, 2011, Tarricone, 2011).

> Metacognitive monitoring is repeatedly cycled as individuals determine if the skills they are using are increasing the likelihood of a desirable outcome or if other skills are needed. When a "good enough" outcome is achieved, the process is stopped.
>
> (Halpern, 2003, p.20)

6.3 Botocrates' tasks

The goal of Botocrates is to engage students in dialogues that could enhance their critical thinking and academic argumentation skills. This type of dialogue can be described as a goal-oriented dialogue, which consists of a sequential process aiming at achieving the goal at the end of the dialogue (Cawsey, 1992, Lee et al, 2006). As I explained earlier, in section *6.2 Botocrates' approach*, promoting students' critical thinking and academic argumentation skills cannot be achieved overnight, therefore the aim of Botocrates is to engage students in a repeated process of reflective thinking through *challenge to explain* dialogues. In order to accomplish the goal of Botocrates, three factors should be taken into account: the initial situation of the dialogue, the goal of students when chatting with Botocrates, and the final purpose of the whole dialogue (Walton, 2014 and 2015). However, it is difficult to anticipate students' behaviours when conversing with Botocrates before implementing the WOZ experiments, which could provide us with deep insights into students' actions (Cypher and Halbert, 1993, Evers and Nijholt, 2003, Rieser and Lemon, 2011). Having said that, the initial design of Botocrates' conversational moves takes into consideration any unexpected moves or any type of utterances so that Botocrates could control the dialogue and accomplish the ultimate goal (see section *6.5 Scenario and dialogue modelling*).

The initial expectation of students' behaviours when chatting with Botocrates is to be engaged in information-seeking dialogues about topics related to the domain of knowledge. In such type of dialogue the information is transmitted from Botocrates to students (Walton, 2010a). The initial situation of the dialogue is that students need information and their final goal is to acquire this information (Carberry, 1990, Walton and Krabbe, 1995, Walton, 2010c). Thus, one of the main tasks of Botocrates is to provide information to fulfil students' goals. When the goal of the student is achieved, as Botocrates satisfies the previous inquiry related to the domain of knowledge, Botocrates' takes the initiative role back from the student in order to establish the starting point towards the engagement in *challenge to explain* dialogues (the mechanism of turn-taking between Botocrates and users are explained later in this chapter, see section *6.5 Scenario and dialogue modelling*). Any agents that aim at achieving particular tasks, such as Botocrates, must take the initiative role in order to control the flow of the dialogue (Stein et al, 1999, Andrews and Quarteroni, 2011). Based on the features and the objectives of both types of dialogue, information-seeking and *challenge to explain* dialogues, Botocrates has two main tasks: a) the first task is related to the domain of Knowledge as an information provider, and b) the second task is related to *challenge to explain* dialogues.

Main task 1: providing information related to the domain of knowledge

In information-seeking dialogues the goal of Botocrates is to pass information to users. The process in an information-seeking dialogue can be viewed as an interactive questioning-answering task (Hobbs, 2002, Rieser and Lemon, 2011). The types of information provided to students could be divided into main categories: a) general knowledge that is not related to subject matter-knowledge e.g. *the capital of the UK is London*, and b) domain-specific knowledge e.g. *HCI stands for Human-Computer Interaction*. Both types of knowledge are required to ensure the interactivity between Botocrates and users. The nature of this type of dialogue can be described as an asymmetrical one because of the asymmetrical distribution of knowledge between Botocrates and users (Walton and Krabbe, 1995, Walton, 2010b, Gambrill, 2012). The success of Botocrates in completing the task relies on the amount of data available in Botocrates' knowledge base. Botocrates should satisfy users by providing them with the right and relative information in order to achieve their goal of the interactions (Walker et al, 2001, Quarteroni and Manandhar, 2007). Users' satisfaction and acceptance are connected to their successful experiences when conversing with the designed chatbot (Abu Shawar and Atwell, 2007b).

The ability of Botocrates to help students to acquire information about the domain of knowledge is essential for argumentation skills as well. Students' engagement in the argumentation process requires knowledge about the topic under discussion (Chinn and Clark, 2013, Baek et al, 2015). Knowledge about the domain is one of the key elements needed in order to take a position, support the taken position by evidence, and defend the argument against other counter-arguments. It could be argued that the abilities of students to consider alternative positions and different explanations regarding any issue relies on their prior knowledge. One of the factors that hinders students being engaged in argumentation is the lack of knowledge (Aufschnaiter et al, 2007, McDonald and McRobbie, 2011). By helping students to acquire knowledge about the subject domain, Botocrates could facilitate their reasoning process to support their argumentation (Donovan and Bransford, 2005, Shavelson, 2010, Okada, 2014). Students' knowledge about different educational theories and concepts enables them to construct and evaluate their arguments (Erduran and Osborne, 2004).

Main task 2: engaging students in challenge to explain dialogue

Throughout this task, Botocrates is designed to engage students in repeated loops of the cycle process of *challenge to explain*. The loops contain different steps and each step has its own procedure. *Figure 27* illustrates the cycle process of Botocrates for engaging students in a *challenge to explain* dialogue.

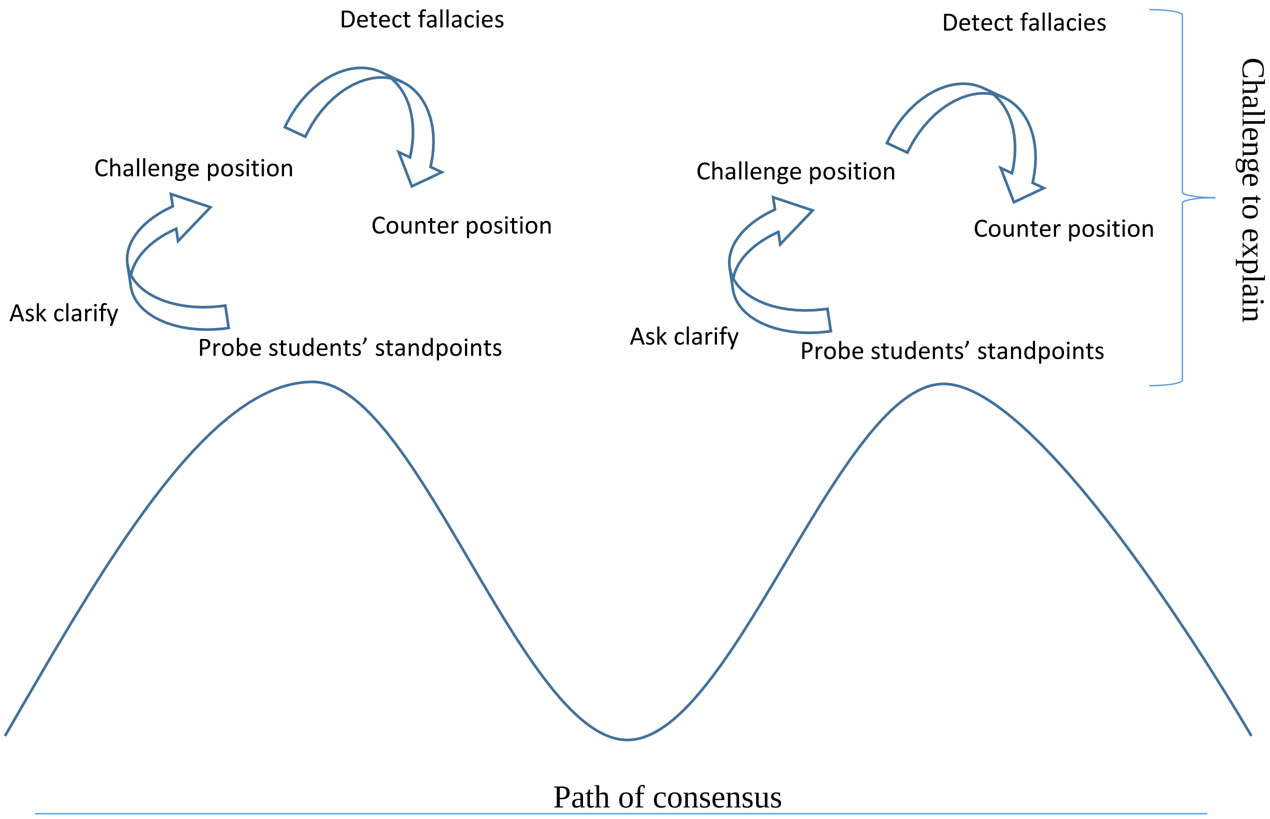


Figure 27: Botocrates' Cycle process of challenge to explain

As *Figure 27* shows, with the intention of establishing *challenge to explain* dialogues, Botocrates starts by probing students' opinions regarding a specific area. When students articulate their positions, Botocrates' next move aims at challenging the taken positions and requesting support or evidence. In the case where the articulated position is not recognized by Botocrates, the next move is designed to ask clarification from students. As soon as students reply with the evidence or the grounds for their position, Botocrates confronts students with counter arguments connected to students' positions. If Botocrates detects any potential fallacies in students' lines of reasoning, Botocrates will inform students of the committed mistakes.

During the process of promoting argumentation skills, Botocrates' cognitive train will repeatedly pass through different cognitive territories in order to help students to be familiar with them. In *Figure 27* above, the area of constructive conflicts represents the cognitive territory that students should experience, where their cognitive abilities can be developed (Cakir, 2008, Chin and Osborne, 2010a). The emphasis here is given to the need to create contradictions and constructive conflict that could trigger the change in students' intellectual behaviours (Garton, 2008, Chipman and Meyrowitz, 2012), which in turn facilitates students' conceptual change (Limón, 2002, Mason, 2002). "Conceptual change is understood as a process through which the individual's prior knowledge is modified to a greater or lesser extent by new information" (Limón, 2002, 260). The path of constructive conflicts in the argumentative process could lead to the assimilation and the accommodation of the new experience (Oakley, 2004, Tuckman and Monetti, 2010, Kail and Cavanaugh, 2015). The development of students' academic argumentation and critical thinking skills implicates an active internalisation of the process of interaction that occurs between Botocrates and students (Brown, 2008). "Internalization is a process in which people accept an argument by thinking about it and by integrating it into their cognitive systems" (Warnick and Inch, 1989, p.285). On the contrary, during the path of consensus, students would not be able to develop their argumentation skills (Singh, 2000). The justifications and the rationales of each step are illustrated in the following subsections.

Probe-Opinion

The aim of Botocrates when asking probing questions is to elicit students' opinions in order to encourage them to take a position regarding a certain topic. The starting point of any argumentation and reasoning process is taking a position (Weigand, 2010, Andrews, 2010). Probing questions could lead students to think deeply as they are required to decide where to allocate their standpoints (Carr et al, 2005). Effective questions facilitate complex thinking, in particular, when students' answers are based on making a comparison between different ideas and positions (Kaplan and Owings, 2014). The key to promoting students' argumentation skills is to focus on types of questions that evoke higher levels of thinking (Brown, 2004, Moore and Stanley, 2010). Asking probing questions plays an important role in establishing dialectical thinking (Walton, 1999, Rundquist, 2007, Grayling, 2010).

> Probing questions ask students to extend their knowledge beyond factual recall and parroting of learner answer, to apply what is known to what is unknown, and elaborate on what is known to deepen their understanding of this knowledge.
>
> (McTighe and Wiggins, 2013, p.56)

I would say that successful probing questions should bring students to areas where different positions can be taken. The differences between opinions (the confrontation stage) is essential to be engaged in the argumentation process (Van Eemeren and Meuffels, 2009, Norman et al, 2013). The notion I produced in chapter five regarding the *constructive expansion of exchange* *structure* (see section *Planning the expansion of exchange structure*) has to have an opening and closing stage. Botocrates' probing questions will be planted in exchange structures in order to establish the starting points of the expansion. Probing students' opinions represents the opening stage within the argumentation process (Andrews, 2010). Moving from the opening stage towards the closing stage of the expansion requires sequential strategic moves (Fans et al, 2009, Walton, 2013a). Botocrates' brain will be modelled to contain different areas of dispute regarding the specific-domain of knowledge. Each area of *challenge to explain* consists of nodes of positions and sub-nodes of support related to those positions.

Ask-Clarification

The goal of clarification questions is to encourage students to clarify their statements in the case where the taken positions are not recognized by Botocrates. Clearing up the confusion by means of clarification questions is a part of repair work which occurs when students chat with Botocrates (Hatch, 1992, Pilkington, 2015). In order to implement the *constructive expansion of exchange structure*, the positions taken by students have to be successfully allocated in Botocrates' brain. In Botocrates' brain there is a set of purposeful conversational moves and the implementation of each move has preconditions that must be met. Challenging students' stances requires a prior condition that has to be achieved, which is the articulation of student's positions. As the findings in chapter five suggest, probing students' opinions will not necessarily be followed by clearly articulated positions. The correct allocation of students' positions will help Botocrates in identifying the nodes of positions and the sub-nodes of support in connection to the taken positions. For example, if a student takes a position *P1* regarding an area of dispute *T,* the sequential process of the expansion will identify *P2* as a counter-argument (see *Figure 26*).

In the case where Botocrates fails to understand (allocate) the student's position the first time, the student's reformulation of her/his position could lead to a better understanding of the meaning of her/his utterance (Tsui, 1994, Sidnell, 2010). Clarification moves aim at establishing a common ground between Botocrates and students (Jurafsky and Martin, 2009). The identification and recognition of students' positions means that students understand and fulfil the commitment of previous moves (Van Eemeren et al, 2007, Grewendorf and Meggle, 2012). Different systems acknowledge the importance of asking clarification questions to users because it helps in performing the accurate actions that lead to achieving the goals of interaction (Jurafsky and Martin, 2009, Quarteroni and Manandhar, 2009, Andrews and Quarteroni, 2011, Zacarias and De Oliveira, 2012). In addition, clarification of the meaning is a vital skill in dialectical dialogue and the argumentation process (Walton, 1998, Ravenscroft et al, 2008, Chesters, 2012). Asking clarification questions could promote students' argumentation skills and boost the clarity of their arguments (Pilkington and Walker, 2003a, Huang, 2010, Matthews and Lally, 2010, Cottrell, 2011).

Challenge

The purpose of challenging questions is to encourage students to develop their assertions into arguments (Crosswhite, 2012). In normal conversational settings, the motive of challenging questions can be because the assertion (the claim) is open to doubt (Walton, 2006). During *challenging to explain*, the intention of Botocrates is to engage students in dialogue where careful consideration and evaluation of their assertions must be taken into account (Fisher, 2001, Govier, 2009). Engaging students in constructive and critical discussion is an essential sub-task of Botocrates. Promoting students' argumentation skills requires posing a critical question that enables students to weigh their arguments (Walton, 2009, Kuhn, 2009a and 2009b). When students justify their positions by stating their grounds and support, they are involved in self-reflection (Paul and Elder, 2006b, Tarricone, 2011). The students' self-reflection process includes the review and the evaluation of their own thoughts, feelings and behaviours (Grant et al, 2002). This process could lead to establishing constructive conflicts needed in order to engage students in a meaningful argumentation process (Mercer and Littleton, 2007, Long et al, 2010, Littleton and Howe, 2010).

When Botocrates raises doubts about students' positions, students start applying the mechanism of persuasion dialogue (Walton, 2014). The key elements in persuasion dialogue are reasons and how evidence could justify students' positions (Norman et al, 2013). At this stage a question might be raised as to whether *challenge to explain* is a persuasion dialogue or not. Types of dialogue can be identified by their final goals (Walton, 2014 and 2015b). The goal of persuasion dialogue is to convince other parties in the dialogue, but the goal of Botocrates is to engage students in reflective thinking in order to promote critical thinking and academic argumentation skills. Persuasion dialogues can be divided into two situations: a dissent and dispute (Walton, 2006). In an asymmetrical dissent situation one party raises a doubt by asking for evidence and the other party responds to remove the raised doubt, while in a symmetrical dispute situation both parties hold positions (argument and counter-argument) (ibid). In order to achieve the goal of Botocrates and implement the gradual occurrence of constructive conflict during *challenge to explain* dialogues, both situations will be applied. During the sub-task: *challeng*e, Botocrates will adopt the dissent situation and merely raise a certain doubt, and through the sub-task *counter*, Botocrates will put forward the argumentation into a dispute situation. For the deliberate practice and the intentional goal of Botocrates both types of attack will be executed (Bex, 2011, Walton, 2015a).

Detect Fallacies

Fallacies can be defined as speech acts mistakenly used in the argumentation process (Searle, 1969, Van Eemeren and Grootendorst, 1984). Such conversational acts are described as “a violation of the criteria of good argument” (Damer, 2008, 243). Botocrates should increase the awareness of students for not committing these types of speech acts in order to promote their argumentation skills. Detecting any potential fallacies requires identifying the errors in the students’ line of reasoning that could cause flaws in arguments (Walton, 1992, Damer, 2008). However, detecting potential fallacies during argumentation is a challenging sub-task for Botocrates’ brain. Types of fallacy can be divided into two sections: formal and informal fallacies (Goodman, 1993, Van Eemeren and Grootendorst, 1984, Walton, 2009). Formal fallacies refer to the errors in the structure or the form of argument, while informal fallacies can be seen as mistakes committed in the content of line of reasoning such as irrelevance or incorrectness (Walton, 1997, McQueen and McQueen, 2010, Shabo, 2010). In order to detect students’ potential fallacies in argumentation during *challenge to explain* dialogues, Botocrates must take two elements into account: looking at the syntax structure of an utterance and the whole content of the argument (assertion, premises, and its warrant) (Searle, 1969).

At this point, I would like to clarify three issues surrounding the abilities of Botocrates in terms of detecting potential fallacies: a) types of fallacies which can be detected by Botocrates, b) the mechanism for detecting these fallacies, c) the actions of Botocrates after detecting the potential fallacies. Botocrates could recognise formal fallacies by examining word order and syntactic features of the utterances. For example, *if* $x = b$ (*if Saudis speak Arabic*) and $b \neq y$ (*Y does not speak Arabic*) *then* $x \neq y$ (*then Y is not a Saudi*) (Godden, and Walton, 2004, Freeley and Steinberg, 2009). Botocrates will detect the formal fallacies by relying on the linguistic devices such as *if, then, therefore*, etc. and their sequential order within utterances. The action of Botocrates when detecting this type of formal fallacy is informing students about a potential flaw in the line of reasoning. The second type of fallacy that can be detected by Botocrates is the type of informal fallacy: irrelevant premises within the line of reasoning. As illustrated earlier, Botocrates' brain contains nodes of positions and sub-nodes of support related to a certain *challenge to explain*. The sub-nodes of supporting evidence are the premises connected to a particular position. In the case where the premises are not recognized by Botocrates because they are not parts of the sub-nodes, then Botocrates will raise a critical and reflective question *(is this relevant? could you explain more?*). Botocrates' brain can be expanded and the new premises could be added into Botocrates' brain by the botmaster if the new premises are related to the topic under discussion.

In addition to the above fallacies, there are two other different types of fallacies that could be committed by students and Botocrates could be capable of detecting these fallacies: appeal to popularity e.g. *because many people believe that*…. and appeal to authority of expertise e.g. *because X says that* (Walton, 1984 and 2010). In both cases Botocrates needs to examine the content such as word order, the syntax features of the utterances and their linguistic devices. When detecting appeal to popularity fallacies, Botocrates will inform students about the mistakes in their line of reasoning. However, if Botocrates detects a potential appeal to authority of expertise fallacy, further critical questions will be needed e.g. Is *X expert in the field? Is X's claim based on evidence?* (Walton, 2006).

Counter

The function of counter is to encourage students to consider alternative positions in connection with the topic under discussion (Kuhn, 1991, Matthews and Lally, 2010, Tittle, 2011). Such alternative perspectives are defined as counter-arguments in the argumentation process (Keeling et al, 2013, Missimer, 2004). The abilities of students to consider and acknowledge others' perspectives when producing their arguments are seen as essential skills in academic argumentation (Andrews, 2010, Carroll, 2013). Counter-arguments should be integrated in students' arguments and acknowledged as a part of the process of convincing others (Rainbolt and Dwyer, 2012). The aim of Botocrates when countering students with a different point of view regarding an area of dispute is to help students to rethink their positions in the light of counter-arguments (Cottrell, 2011, Nickerson, 2013). This practice in turn could enable students to give rational considerations to their initial positions (Felton et al, 2015). During *challenge to explain*, the main goal when countering students with different opinions is not to refute students' initial positions, but Botocrates' goal is to create situations where students could re-evaluate and re-weigh their early standpoints (Kuhn, 2009a, Wootton, 2010, Halpern, 2013). This constructive conflict could prompt students to reconstruct their prior knowledge

(Ram and Leake, 1995, Limón, 2002, Mason, 2002) and further the development of their cognitive abilities (Cakir, 2008, Chin and Osborne, 2010b, Garton, 2008, Chipman and Meyrowitz, 2012).

> Higher order thinking occurs when a person takes new information and information stored in memory and interrelates and/or rearranges and extends this information to achieve a purpose or find possible answers in perplexing situations.
>
> (Lewis and Smith, 1993, p.136)

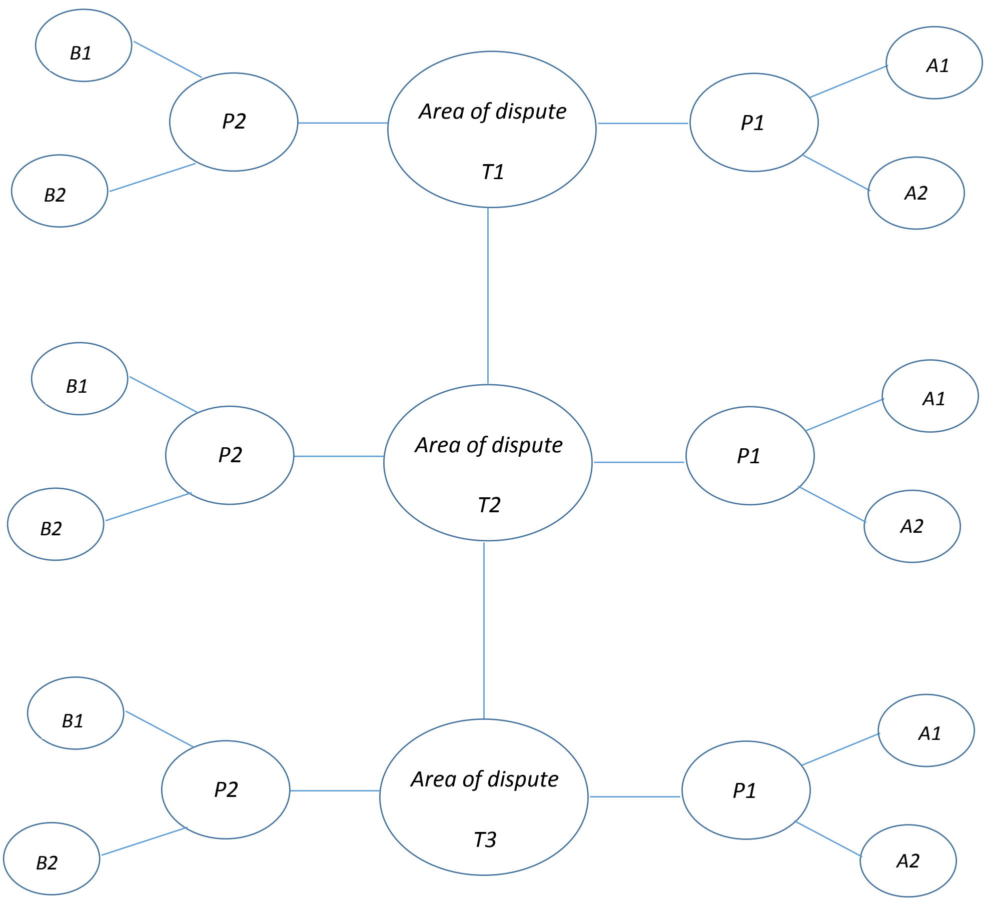


Figure 28: The tree of nodes of positions and the sub-nodes of supports in Botocrates' brain

As *Figure 28* shows, the identification of student's positions regarding an area of dispute leads to the identification of the counter-arguments associated with the taken position. For example, if a student's position related to an area of dispute *T1* is recognized by Botocrates as *P1*, the counter process will recall *P2* as a counter-argument and vice versa. By the end of this step, Botocrates successfully executes a particular loop within the cycle process of *challenge to* *explain* dialogue. The engagement in another loop of the *challenge to explain* will be proposed by Botocrates based on its relevance to the topic under discussion.

6.4 Academic Argumentation Machine (AAM)

This section aims to 'theoretically' introduce the components of Botocrates' brain that could achieve the goal of interactions. In this section, I would like to refer to Botocrates' brain as an Academic Argumentation Machine (AAM). As illustrated earlier, there are two main tasks that should be performed by Botocrates: a) providing information, and b) engaging students in *challenge to explain* dialogues. Each task has its own requirements and dialogue strategies needed to be achieved within the AAM. The components of the AAM are responsible for executing the process required during chatting with Botocrates. The notion of the AAM is inspired by the work of Gilbert et al (2003) when they produced a Persuasion Machine (PM). The goal of Botocrates differs from the goal of the Persuasion Machine (PM) as the latter aims at persuading users of some points of view e.g. quitting smoking, losing weight etc. Gilbert et al (2003) represent theoretically and hypothetically the processes inside the PM. According to Gilbert et al (2003), the agent needs to understand users' utterances to act accordingly. By understanding the content of argumentation and employing a dialogue model the system could react in a way that leads to achieving the goal of interaction (ibid). Let us look at *Figure 29* below that illustrates the components of the AAM:

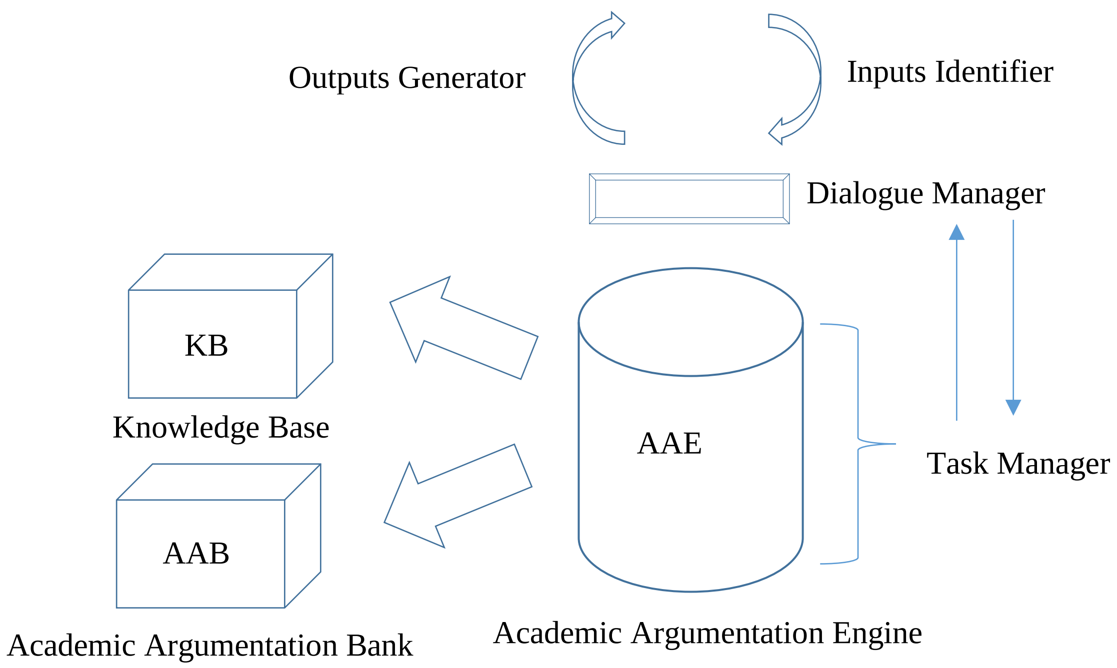


Figure 29: Academic Argumentation Machine AAM

As *Figure 29* shows, one of the main components of the AAM is users' Input Identifier (INI), which is responsible for determining the types of a user's conversational moves performed in users' inputs. It also should determine whether the user's utterances contain multiple moves or only a single move. The identification of dialogue acts or conversational moves made by users when conversing with Botocrates could successfully lead to achieving the task of the dialogue (Jokinen, 2009, Berg, 2015). For example,

User: *Hi Botocrates, what does 'inter-thinking' mean*?

Greet Request-Info

Example 34: The identification of dialogue acts or conversational moves made by users

In order to recognize which conversational moves are implemented by users, agents could rely on the syntax features of utterances, such as word order and collocations, and the conversational structure e.g. '*yes*' could be *accept* or *agree* moves based on the previous conversational moves (Jurafsky et al, 1997, Jurafsky and Martin, 2004 and 2009). Detecting users' conversational intention is very important in dialogues, which must be modelled in order to test the usability of Botocrates' process (Novielli and Strapparava, 2011). The identification of users' conversational moves helps Botocrates to generate appropriate responses (Friedenberg, 2010). Each response is linked to the goal of a task or a sub-task in Botocrates' brain (Traum et al, 2008, Andrews and Quarteroni, 2011). It must be borne in mind that at this stage of the study, the wizard classifies the types of users' conversational moves based on the decision tree designed for this purpose. For example, *Figure 30* shows some of the descriptions that could enable the wizard to recognize and identify users' moves. This method of classification can be applied in the early stage of a project to test the usability of the process (Kerly and Bull, 2006).

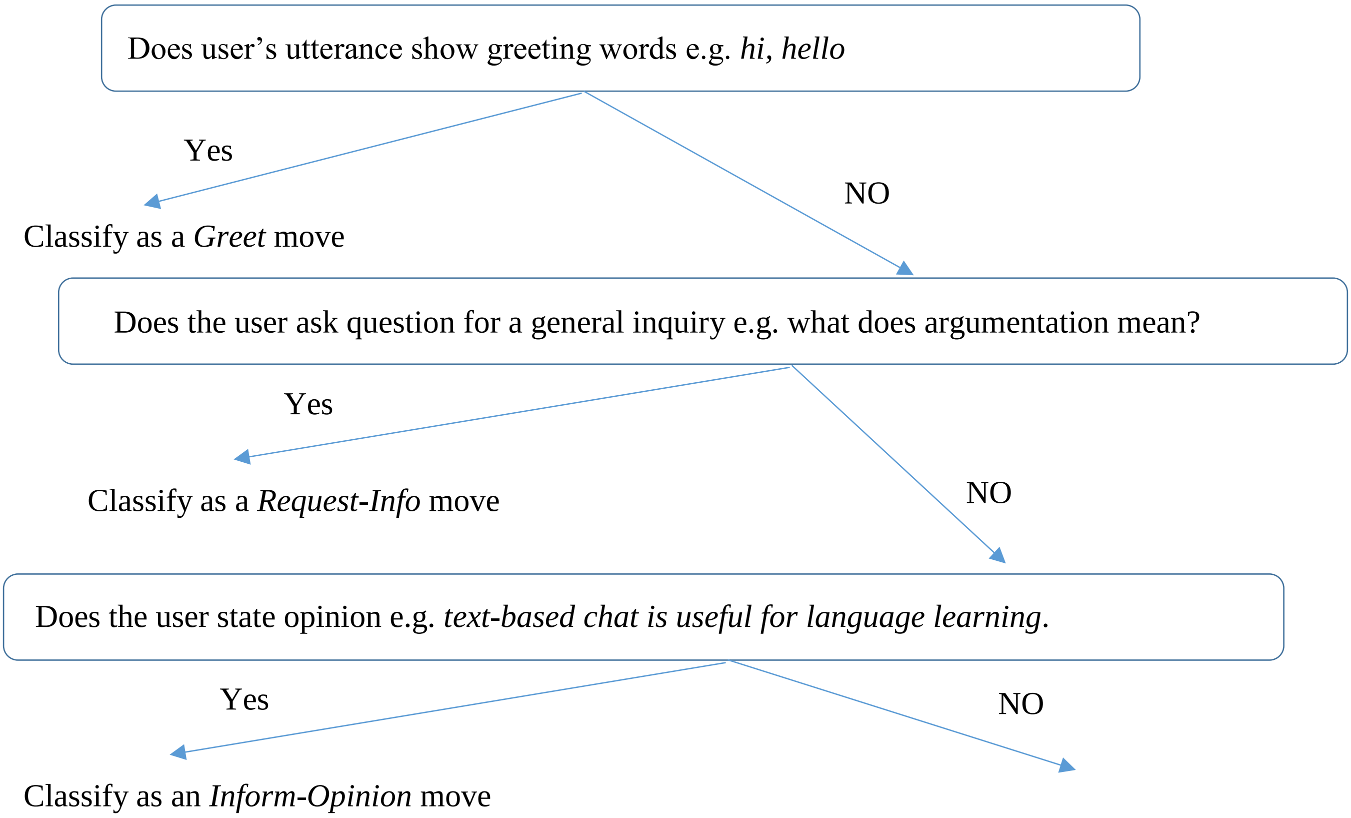


Figure 30: A part of the Decision Tree given to the Wizard to identify users' conversational moves

The second component of the AAM is the dialogue manager (DM). The DM is responsible for controlling and managing the structure and the flow of the dialogue (Montero and Araki K 2007, Jurafsky and Martin, 2009). The actions of the DM must be predefined to deal with any possible moves made by users (Jokinen, 2009). During the *challenge to explain* process, the Academic Argumentation Engine (AAE) is utilized for informing the AAM and its DM about which moves should be implemented as a response to a user's input (Gilbert et al, 2003).The decision of the next move is planned and executed according to preconditions that must be held by Botocrates in order to perform certain actions (Keizer et al, 2012, Novielli and Strapparava, 2011). For instance, the conversational move *Give-Info* is linked to the precondition: performing a *Request-Info* move by the user. During the WOZ experiments, the wizard will be provided with key actions and decision protocols that show what next moves need to be implemented according to users' current moves.

Current users' move	Botocrates' next move
IF: Greet	**THEN:** Greet AND Introduce AND Ex-St-Opener
IF: Bye	**THEN:** Closing-statement AND Bye
IF: Request-Info	**THEN:** Give-Info AND Ex-St-Opener
IF: Accept-Offer	**THEN:** Probe-Opinion
IF: Inform-Opinion	**THEN:** Why-question

Table 32: Example of Key actions from the wizard's decision protocol

AAE is linked to two databases: Knowledge Base (KB) and Academic Argumentation Bank (AAB). The function of these databases is to provide the content of any response produced by Botocrates. The KB includes information related to general knowledge and domain-specific knowledge. The KB is an important element for performing the goal of information-seeking dialogues (Simon et al, 2004, Habernal et al, 2012). The AAB contains the nodes of positions and the sub-nodes of support related to different areas of *challenge to explain*. Each area of *challenge to explain* encompasses the structures of arguments and their counter-arguments in the AAB.

During the process of *challenge to explain*, the AAM relies on the AAE and the AAB to accomplish the process and feed the dialogue. The AAE is linked also to the Task Manager (TM), which consists of knowledge related to the task domain or how to perform the task (Jurafsky and Martin, 2009, Woudenberg, 2014). The allocation of users' input in the AAB can help the DM to decide which action should be implemented next as a part of the loop of *challenge to explain*. The process of allocating a certain assertion in the AAB requires analysing and assessing a user input in the AAE. In the case where the assertion (position=*Inform-Opinion* move) is allocated in the AAB, AAE and TM can inform the DM to execute and recall the process of the next step of *challenge to explain* based on argument schemata.

The final component of Botocrates' brain is the Output Generator (OUG). The function of this part is to produce Botocrates' outputs. Generating sentences in natural language requires selecting the right syntactic structure in order to express the correct meaning (Jurafsky and Martin, 2009). During this stage of the study, the wizard will be provided with 'canned' responses linked to particular moves e.g. '*Greet*': '*Hi there*?' Why-question move: '*why do you think that?'* When users' input contains more than a single move, the response to each move will be ordered in the OUG and will be presented as a part of Botocrates' response. The AAM should take into account Grice's maxims when generating responses to users in order to be well understood (Friedenberg, 2010, Hu et al, 2013).

However, it must borne in mind that the above description is not meant to explain or to reveal the final and completed dialogue management systems. The aim of the theoretical description of the Academic Argumentation Machine (AAM) is ONLY to provide readers with the tasks of the wizard and some of the tools needed during this stage of the research study. The process of implementing the WOZ technique and the tools used are illustrated in further details in chapter 4, section *Procedures of recording and collecting wizard of Oz data*. The main concern at this stage of the study is to test the usability and the applicability of Botocrates' dialogue strategies.

> A WOZ system can be used to test out an architecture without implementing the complete system; only the interface software and databases need to be in place.
>
> (Jurafsky and Martin, 2009, p.836)

> Wizard-of-Oz testing is a particular user research technique that is useful for applications with complex interaction flows during the very early stages of the design process.
>
> (Bouwen, 2007, p.154)

6.5 Scenario and Dialogue Modelling

The term scenario can be defined as a story about users and their interactions with Botocrates (Carroll, 2000a, Go and Carroll, 2003). The narrative description of the envisioned interactions could help the designer take into account different situations that may occur (Rosson and Carroll, 2002). Although it is challenging to predict the entire set of possible users' behaviours when chatting with Botocrates before the WOZ experiments (Cypher and Halbert, 1993, Evers and Nijholt, 2003, Rieser and Lemon, 2011), it is important to recognise an initial set of predictable scenarios that may happen (Chiang and Tomimatsu, 2011).

> Scenarios evoke reflection in the content of design work, helping developers coordinate design action and reflection. Scenarios are at once concrete and flexible, helping developers manage the fluidity of design situations. Scenarios afford multiple views of an interaction, diverse kinds and amounts of detailing, helping developers manage the many consequences entailed by any given design move.
>
> (Carroll, 2000b, p.43)

The dialogue model is defined as the representation of dialogue strategies and protocols (Luis, 2010, Fabian et al, 2011b). In this process, tactics (purposeful moves) refer to the short-term goals of interaction, and dialogue strategies refer to the long-term goals of interaction (Sottilare et al, 2014). The model of the dialogue shows the structure and the process of interaction that may take place between Botocrates and users (Jokinen, 2009, Bel-Enguix et al, 2009, Fabian et al, 2011b). The tasks and sub-tasks of Botocrates can be achieved by implementing particular strategic manoeuvres during the interaction with users (Walton, 1998, Zarefsky, 2014). Applying such intentional manoeuvres can be carried out by means of conversational moves (Edmondson, 1981, Pilkington, 1999, Walton, 2003). The dialogue strategies of Botocrates in this section are represented in a set of tactics based on the current circumstance of interaction (Sottilare et al, 2014).

Based on the tasks and sub-tasks of Botocrates (see section *6.3 Botocrates' tasks*), the initial version of Botocrates' dialogue strategies was designed to deal with four main types of dialogue floor: a) social conventions floor, b) information-exchange floor, c) probe-exchange floor, and d) *challenge to explain* floor. While a) a social convention floor, b) an information-exchange floor, and c) a probe-exchange floor can be labelled as user-initiation floors, a *challenge to explain* floor can be referred as a Botocrates-initiation floor. As we can notice this type of interactivity when users interact with Botocrates can be described as a mixed-initiative dialogue. In a mixed-initiative dialogue, either users or the agent can initiate a new exchange structure (Blandford, A. 1995, Karat et al, 2002, Woolf, 2010). Therefore, it is expected that both Botocrates and users can direct the flow of the dialogue.

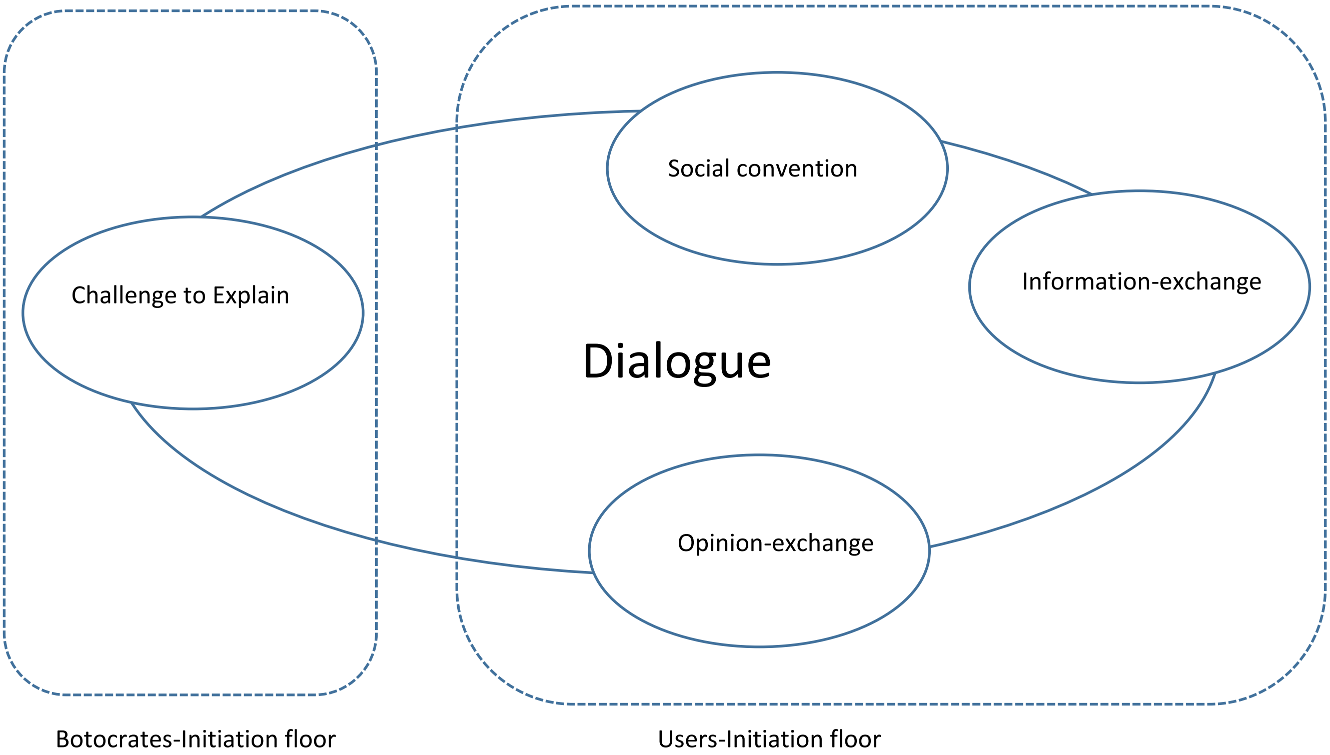


Figure 31: Types of dialogue floor that may take place between Botocrates and users

In case the user initiates any turn that is not relevant to the above four floors, Botocrates will respond by performing a *Backchannel* move *"Uh-huh"* followed by a *Direct* move "*Let us chat about topics related to the Module EDUC5256M"* and an *Ex-St-Opener* move "*Would you like to ask me a question or should I select a topic of my area of interest?"*. At this stage of the design it is better to focus on the main tasks and sub-tasks, otherwise Botocrates could get distracted by off-task conversation. "Off-task conversation would involve doing unnecessary or meaningless things instead of focusing on what is important" (Gulz et al, 2011, p.146).

> Most implementations in dialogue research are task-oriented systems intended to solve a clearly defined problem, or to examine a given research topic.
>
> (Lockelt, 2011, 157)

Before explaining the process of dialogue related to each floor, it is essential to define the intentional communicative moves that could reflect the nature of dialogues (Beveridge and Milward, 2003, Andrews and Quarteroni, 2011). In a task-oriented dialogue, conversational moves can be classified into two categories: a) task-oriented moves, and b) dialogue control moves (Bunt, 2000, Taylor et al, 2000, Lester et al, 2013, Devault and Stone 2014). While task-oriented conversational moves have the functions connected to achieving the main goal of interaction such as *Probe-Opinion, Why-Question, Counter, Request-Infor, Give-Info* moves, dialogue control moves are used to manage and control the dialogue such as *Greet, Bye, Ex-St-Opener, Direct* moves.

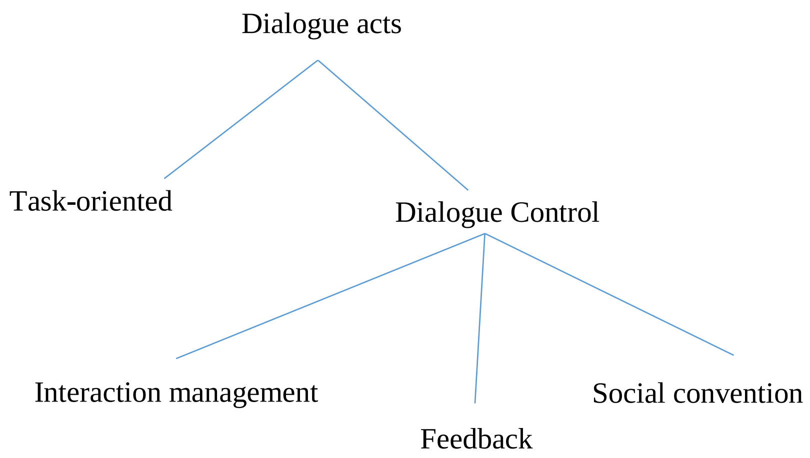


Figure 32: The categories of conversational moves in task-oriented dialogue according to their communicative functions

(Bunt, 2000, p.91)

Table 33 & *Table 34* show the moves used for addressing each dialogue floor and their definitions. The conversational moves used for this research study were adopted from previous studies and taxonomies of conversational moves (Jekat et al, 1995, Pilkington, 1999, walker, 2003, Kluwer, 2011b).

NO	**Botocrates' main conversational moves**	**Description**
1	Direct	Instruct to direct the dialogue. "*Let us chat about topics related to the Module EDUC5256M"*
2	Give-info	Retrieving information about the domain knowledge or general knowledge from the knowledge base e.g. "*In conversation a turn can be defined as …….."*
3	Ex-St-Opener	Invite the user to start a new exchange structure *"Would you like to ask me a question or should I select a topic of my area of interest?"*
4	Probe-Opinion	Ask question to elicit user' opinion e.g. "*Do you think using text chat could promote language learning?"*
5	Ask-clarify	Ask clarification question e.g. "*what do you mean? Can you elaborate please"*
6	Why-question	Ask why question to elicit a defence of a line of argument e.g. "*why do you think that*?"
7	Counter	State an alternative line of argument e.g. "*yes but ….*"
8	Hint	Give information to bridge the gap between user's lack of knowledge and the information needed to be engaged in argumentation
9	Fallacy-detection	Based on the type of fallacy, Botocrates Informs or asks-clarification questions to the user about potential fallacy committed in the last utterance e.g. "*is X expert in this area*? *Is X's claim based on evidence?*"
10	Feedback	An evaluation of user's previous utterance.
11	Greet	Greeting words e.g. *hi*, *hello*?
12	Introduce	State introducing statement e.g. "*I am Botocrates ….* "
13	Closing-statement	State closing statement to end the chat e.g. "*it was nice to chat with you*"
14	Bye	State Goodbye words e.g. "*goodbye, bye*"
15	Backchannel	Evidence of understanding previous turn e.g. "*I see" "Uh-huh"*
16	Request-Formulate	Request the user to reformulate the previous utterance e.g. *"Something went wrong! Can you reformulate your sentence?"*

Table 33: Botocrates' main conversational moves

NO	User's main conversational moves	Description
1	Request-info	Ask question for a general inquiry e.g. "*what does academic argumentation mean?*"
2	Inform-opinion	State opinion e.g. "*using text chat can negatively affect language learning*".
3	Give-reason	State causal proposition e.g. "*because … , due to …*"
4	Fallacy	Flaw in user's line of reasoning e.g., "*because x says that*"
5	Acknowledge-Counter	A move that shows acknowledgment the other side of argument.
6	Defend-attack	Defend a certain position against counter-arguments
7	Check-confirm	Ask for confirmation e.g. "*is it right?*"
8	Greet	Greeting words e.g. *"hi, hello"*
9	Introduce	Self-introduce statement e.g. "*I am James*"
10	Closing-statement	State closing statement to end the chat e.g. "*it was nice to chat with you*"
11	Bye	Goodbye words e.g. "*goodbye, bye*"
12	Disagree	Explicit objection e.g. "*I disagree*"
13	Agree	Explicit commitment e.g. "*I agree, yes, right*"
14	Thank	Express gratitude e.g. *"thanks, thank you"*
15	Apology	Express regret or sympathy e.g. "*sorry*"
16	Backchannel	Evidence of understanding previous turn e.g. "*I see*" "*Uh-huh*"
17	Feedback	An evaluation of Botocrates' previous utterance.
18	Abounded	Uncompleted utterance e.g. "*you ar*"
19	Unclassified	An utterance that is not related to any categories in the list of Botocrates' communicative moves

Table 34: Users' main conversational moves

Social convention floor

A social convention floor refers to any floor initiated by a user that shows social conventions moves such as *Greet* moves e.g. "*hi*", "*hello*", and *introducing* moves e.g. "*I am George*", "*Goodbye*", "*Goodnight*" etc. These types of move are expected to take place at the beginning and at the end of the chat. Such moves take care of the social norms occurring in natural language interaction (Bunt, 2013a, Duplessis et al, 2013).

Expected scenario:

At the beginning of each chat, the user may greet Botocrates. Botocrates will respond by greeting the user back, introducing himself and inviting the user to start a new topic. Here an introducing move made by Botocrates does not anticipate a response because it is followed by a new exchange structure opener move that invites the user to start a new topic. If the user responds to the introduce move by introducing her/himself or by stating a *feedback* on Botocrates' *introduce* move, Botocrates will respond by inviting the user to start a new topic. The user also might greet Botocrates and ask a question in the same turn, in this case Botocrates will greet the user back and respond to the question followed by inviting the user to start a new topic.

At the end of each chat, the user also could end their chats by saying e.g. "*Bye, Goodbye, Goodnight etc.*" to Botocrates, Botocrates will respond to the user by stating a closing statement "*it was nice to chat with you*" followed by a *Bye* move. Also the user might respond to the invitation of Botocrates to start a new topic by stating "*I have to leave*" "*I have to go*", Botocrates will respond by stating closing statement "*it was nice to chat with you*" followed by "*Bye*"

Example of the set of tactics (purposeful moves) for addressing a social convention floor:

(1)

- If the user initiates a new exchange structure (I) by a *Greet* move, then Botocrates will respond (R) by performing a *Greet* move, *Introduce* move (I), followed by an *Ex-St-Opener* move (I).

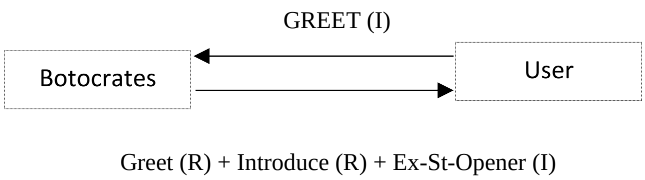


Figure 33: Flowchart represents a typical Greet move in a social convention floor

For example,

X: *Hello*

Botocrates: *Hello there! I am Botocrates.I was born in the School of Education at the University of Leeds. I am here to answer any questions related to the Module EDUC5256M. Would you like to ask me a question or should I select a topic of my area of interest?*

Example 35: One of the expected scenarios of Greet move

- If the user performs a *Bye* move, then Botocrates will reply by performing a *Closing-statement* move followed by a *Bye* move.

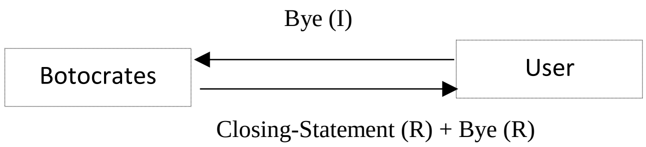


Figure 34: Flowchart represents a typical Bye move in a social convention floor

For example,

X: *Bye*

Botocrates: *it was nice to chat with you! Bye*

Example 36: One of the expected scenarios of Bye move

User's action	The Wizard's action
IF: the user Responds to an *Introduce move* made by Botocrates by *an introduce* move.	**Then:** Botocrates will reply by a *Welcome* move *"Pleased to meet you"* followed by an *Ex-St-Opener* move *"Would you like to ask me a question or should I select a topic of my area of interest?"*
IF: the user makes a *Greet* move AND followed by a *Request-Info* move e.g. "*Hi Botocrates, what is HCI*?	**Then:** Botocrates will reply by *a Greet* move *"Hello there"* followed by a *Give-info* move followed by an *Ex-St-Opener* move.
IF: the user performs a *Greet* move AND followed by an *Introduce* move	**Then:** Botocrates will reply by *a Greet* move *"Hello there"* followed by an *Introduce* move followed by an *Ex-St-Opener* move.
IF: the user responds to an *Ex-St-Opener move* by a *closing-statement* move *"it was nice to chat with you"*, *"I have to go"*, *"I have to leave"*.	**Then:** Botocrates will reply by *a closing-statement* move followed by a *Bye* move

Table 35: Key actions for other possible events related to a social convention floor

Information-exchange floor

An information-exchange floor refers to the floor initiated by users which carry either a) information-seeking or b) information-stating moves. While in an information-seeking floor the user asks Botocrates a specific question, in an information-stating floor the user states a specific fact or some knowledge related to the specific domain or general knowledge.

Information-seeking floor

Expected scenario:

The user initiates a new exchange structure by asking Botocrates a question. Botocrates will respond by passing the required information from the knowledge base to the user and inviting the user to start a new topic. In case the user asks two questions in the same turn Botocrates will answer the questions and invite the user to start a new topic. If Botocrates could not find the answer in the knowledge base, Botocrates will respond by informing the user that the answer was not found and inviting the user to start a new topic.

Example of the set of tactics (purposeful moves) for addressing information-seeking:

(1)

- If the user performs a *Request-Info* move, then Botocrates will reply by performing a *Give-Info* move followed by an *Ex-St-Opener* move.

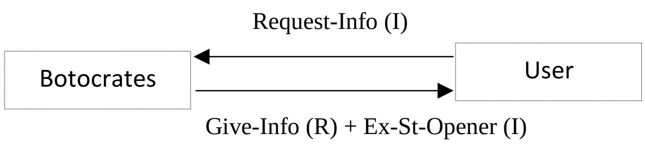


Figure 35: Flowchart represents a typical information-seeking floor

User's action	The Wizard's action
IF: the user performs a *Request-Info* move AND the knowledge base does not contain a related answer	**Then:** Botocrates will reply by generating the canned response: *"Oops I have no answer, sorry my brain is under construction. I hope next time you will find the answer as the botmaster is feeding continuously my brain."* Followed by an *Ex-St-Opener* move.
IF: the user asks two or more questions in the same turn by performing a two or more *Request-Info* moves in the same turn *e.g. what does challenge to explain mean? What is a scaffolding?*	**Then:** Botocrates will perform two *Give-info* moves to answer each question, followed by an *Ex-St-Opener* move.
IF: the user performs a *Ask-Clarify* move after Botocrates' *Give-Info move*	**Then:** Botocrates will reply by making another *Give-Info* move followed by an *Ex-St-Opener* move

Table 36: Key actions for other possible events related to an information-seeking floor

For example,

X: *what does challenge to explain mean?*

Botocrates: *Challenge to explain refers to a situation in which a reason or supporting evidence is given and stated as a response to other's explicit question and challenge move. Would you like to ask me a question or should I select a topic of my area of interest?*

Example 37: One of the expected scenarios if the answer was found

If the answer was not found,

X: *what does dialogue management system mean?*

Botocrates: *Oops I have no answer, sorry my brain is under construction. I hope next time you will find the answer as the botmaster is continuously feeding my brain. Would you like to ask me a question or should I select another topic of my area of interest?*

Example 38: One of the expected scenarios if the answer was not found

Information-stating floor

Expected scenario:

The user initiates a new exchange structure by stating a fact or knowledge. The fact here refers to any knowledge stored in Botocrates' knowledge base. Botocrates will respond by passing related information from the knowledge base to the user and inviting the user to start a new topic.

Example of the set of tactics (purposeful moves) for addressing information-stating:

(1)

- If the user initiates a new floor and performs a *Give-info* move, then Botocrates will reply by performing a *Give-Info* move followed by an *Ex-St-Opener* move.

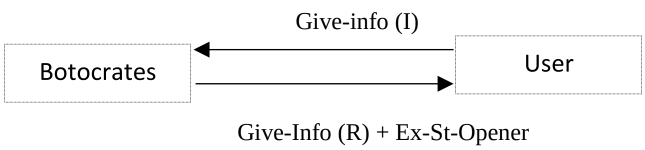


Figure 36: Flowchart represents a typical information-stating floor

User's action	The Wizard's action
IF: the user initiates a new floor and performs a *Give-Info* move AND the knowledge base does not contain any related information	**Then:** Botocrates will reply by generating the canned response: *"Oops I have no related information, sorry my brain is under construction."* Followed by an *Ex-St-Opener* move.

Table 37: Key actions for other possible events related to an information-stating floor

For example,

X: *Challenge to explain refers to a situation in which a reason or supporting evidence is given and stated as a response to other's explicit question and challenge move.*

Botocrates: *Zone of Proximal Development ('ZPD') could bridge the gap between what people know and what they can know when interacting with their social environment. Would you like to ask me a question or should I select a topic of my area of interest?*

Example 39: One of the expected scenarios if the related information was found

X: *Artificial Intelligence is a branch of computer science*

Botocrates: *Oops I have no related information, sorry my brain is under construction. Would you like to ask me a question or should I select another topic of my area of interest?*

Example 40: One of the expected scenarios if the related information was not found

Opinion-exchange floor

An opinion-exchange floor refers to the floor initiated by users which convey either a) Opinion-seeking or b) Opinion-stating moves. While in opinion-seeking moves, users ask questions to elicit Botocrates' opinions about specific issues, in opinion-stating moves, users state their own opinions about particular topics.

Opinion-seeking floor initiated by user

Opinion-seeking floors initiated by users refer to any moves that ask questions to elicit Botocrates' opinions. Users may ask a question such as *Do you think mobile learning could promote language learning?* For the consistency of Botocrates' actions such a question cannot be categorized as *Request-Info* move. While information-seeking floors represented in *Request-info* moves require merely retrieving the related answers from the knowledge base and passing the information to users, probe-opinion floors initiated by users need to be carefully addressed in order to achieve the goal of promoting thinking skills. It could be said that the classification of conversational moves should be solid and consistent in order to capture the dialogue's manoeuvre otherwise an overlap between different categories may occur (Gemrot et al, 2012). Here the main consideration is given to the subsequent moves. Each dialogue move has its own commitment and goal of interaction (Van Eemeren et al, 2007, Grewendorf and Meggle, 2012). Walton (2013b) argues that each strategic communicative move has its own distinct rules of procedures.

I would say that probe-opinion floors initiated by users could be great opportunities that may help them to be engaged in reflective practice. The motive behind asking questions such '*what do you think about?',* or other probe opinion questions, could be because users may feel the raised issues are challenging in their practical environments and professional careers or they might have a positive/negative attitude towards this issue (Bassot, 2015). If the goal is to promote a deep level of thinking, Botocrates does not need to rush with the answers to these questions but the need is to encourage users to express their thoughts about the issues under discussion (Hedley et al, 2013, Bassot, 2015). Botocrates should take advantage of such situations in order to enhance users' levels of thinking by putting their values and knowledge "into practice in making decisions" (Newton, 2012, p.46). The reflective discussion in turn facilitates the development of independent thinking (Lindhard, 1987, Moeller and Moeller, 2014).

Expected scenario:

The user initiates a new exchange structure to ask Botocrates about his opinion regarding a certain issue. Botocrates will respond to the user and direct the question back to the user "*I am interested to know your opinion!"* followed by a probing question "*what do you think?*" If the user states her/his opinion without any support, Botocrates will ask a question requesting a causal proposition for her/his opinion. If the user states the support, Botocrates will check whether the stated line of reasoning contains any potential fallacies or not. Where Botocrates detects any potential fallacies, he will respond to the user informing her/him about the potential error in the line of reasoning and ask for clarification (see detecting fallacies process in this section). In response to a *fallacy-detection* move, the user may ask a question or might disagree or give feedback. If the user disagrees or gives feedback, Botocrates will perform a *feedback* move and invite the user to start a new topic. If the user initiates a new turn to ask Botocrates about fallacies, Botocrates will respond by giving information to the user and inviting her/him to start a new topic. In case the user's line of reasoning does not contain any potential fallacies, Botocrates will perform a *feedback* move and invite the user to start a new topic.

Another possible scenario is that the user may state her/his opinion and line of reasoning in the same turn in reply to Botocrates' *probe-opinion* moves. In this case, Botocrates will check any potential fallacies and if no potential fallacies are detected, Botocrates will perform a *feedback* move and invite the user to start a new exchange structure. In case the user initiates a new turn that is not related to the current exchange structure by requesting information or performing any other unrelated moves, Botocrates will deal with the new exchange structure accordingly. *Table 38* shows the actions and the process of Botocrates for checking any potential fallacies in the user's line of reasoning.

User' action	The Wizard's action
IF: the user's line of reasoning contains possible appeal to popularity e.g. "*because many teachers believe that….* "	**Then:** Botocrates will reply by stating that "*it seems that you have committed an appeal to popularity fallacy. If many believe something that does not mean it is true? Are their beliefs based on valid evidence?"*
IF: the user line of reasoning contains possible appeal to expertise fallacies e.g. "*because X says that…*"	**Then:** Botocrates will reply by stating that "*it seems that you have committed an appeal to expertise fallacy. Is X expert in the field? Is X's claim based on evidence?"*
IF: the user's line of reasoning contains formal syllogism fallacies e.g. **,** *if* $x = b$ *and* $b \neq y$ *then* $x \neq y$, *if* $x = b$ *and* $b \neq y$ *so* $x \neq y$	**Then:** Botocrates will reply by stating that "*it seems that you have committed formal syllogism fallacies. Check your logical deduction again!*
This type of fallacy only can be detected in the *challenge to explain* process	
IF: the user's line of reasoning contains possible irrelevant premises fallacies. Note that, this type of fallacy can only be detected in the *challenge to explain* process as the related premises are stored in the sub-nodes of support in AAB	**Then:** Botocrates will reply by stating that "*is that relevant, can you explain more?* In case the stated line of reasoning is relevant, Botocrates' AAB will be expanded (by the designer) to include the stated premises in the related sub-nodes of support.

Table 38: Key actions for detecting potential fallacies

(Walton, 2006)

Example of the set of tactics (purposeful moves) for addressing a probe-opinion floor initiated by users:

- If the user initiates (I) and performs a *probe-opinion* move, then Botocrates will perform more than a single move in the same turn to deal with such a move. The first move of Botocrates is Respond (R) with a *Direct* move *'I am interested to know your opinion!'* followed be re-initiate (RI) move: a *probe-opinion* move *'What do you think?'*
- If the user states her/his opinion (*Inform-Opinion*) without a support (*Give-Reason*) move, then Botocrates will re-initiate (RI) with a *Why-Question* move.
- If the user performs a *Give-Reason* move and it does not contain any potential fallacies, then Botocrates will close the floor by performing a *feedback* move and invite the user to start a new exchange structure by means of an *Ex-St-Opener* move.

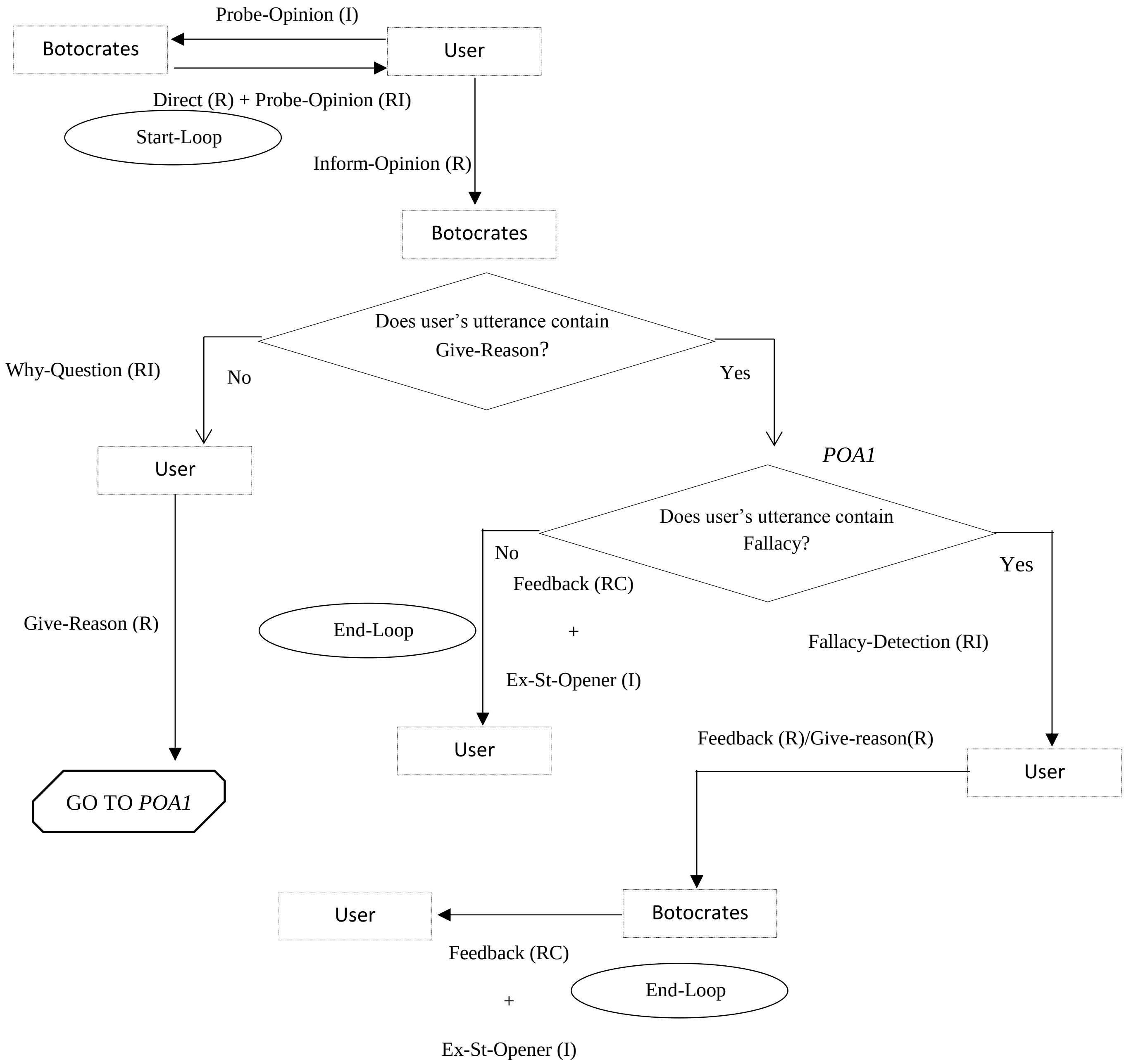


Figure 37: Flowchart represents a typical probe-opinion floor initiated by users

For example,

X: *What do you think about the use of blogging in language teaching and learning?*

Botocrates: *I am interested to know your opinion! What do you think?*

X: *I think it is beneficial*

Botocrates: *Why do you think that?*

X: *Because it provides learners with opportunities to write and communicate with their peers in an interactive way.*

Botocrates: *That sounds good. Would you like to ask me a question or should I select a topic of my area of interest?*

Example 41: One of the expected scenarios of an opinion-seeking floor

User's action	The Wizard's action
IF: the user states her/his opinion (*Inform-Opinion*) followed by a support (*Give-Reason*) move and no potential fallacies were detected	**Then:** Botocrates will close the floor by performing a *feedback* move and starting a new exchange structure by means of an *Ex-St-Opener* move.
IF: the user's line of reasoning (*Give-Reason*) move contains a potential fallacy	**Then:** Botocrates will reply with a *Fallacy-Detection* move.
IF: the user replies to a *Fallacy Detection* move by e.g. *disagree, Feedback*	**Then:** Botocrates will perform a *feedback* move and invite the user to start a new exchange structure by means of an *Ex-St-Opener* move.
IF: the user replies to a *Fallacy Detection* move by performing an *agree* move.	**Then:** Botocrates will perform a *backchannel* move and invite the user to start a new exchange structure by means of an *Ex-St-Opener* move.
IF: the user initiates a new exchange structure at any stage of an opinion-seeking floor.	**Then:** Botocrates will implement the process associated with the new and current floor

Table 39: Key actions for other possible events related to an opinion-seeking floor

Another possible case related to a probe-opinion floor is that users might ask a *why-question*. For instance, '*why do you think the use of blogging in language teaching and learning is beneficial?*' As illustrated earlier in this chapter, see section *Probe-Opinion*, such a question requires a prior condition which is taking a position. Therefore, Botocrates will deal with this sort of question as a part of a probe-opinion floor. For example,

X: *why do you think the use of blogging in language teaching and learning is beneficial?*

Botocrates: *I am interested to know your opinion! What do you think?*

X: It provides learners with opportunities to write and communicate with their peers in an interactive way

Botocrates: *That sounds good. Would you like to ask me a question or should I select a topic of my area of interest?*

Example 42: One of the expected scenarios related to an opinion-seeking floor

Opinion-stating floor initiated by user

Opinion-stating floors initiated by users refer to any moves that carry users' opinions about particular topics. For dealing with this floor, Botocrates will challenge the user to state the line of reasoning that supports the taken position. When users state their opinions, Botocrates' actions will implement the sequence of moves required for producing the minimal structure of argumentation: a) taking a position, b) stating a valid line of reasoning (Govier, 2009, Crosswhite, 2012).

Expected scenario:

The user initiates a new exchange structure by stating her/his position regarding a certain issue. Botocrates will request support for the taken position. If the user states the line of reasoning, Botocrates will check whether the user's utterance carries any potential fallacies or not. Where Botocrates notices any potential fallacies, he will reply to the user informing her/him about the potential flaw in the line of reasoning to encourage the user to consider such error. In response to a *fallacy-detection* move, the user may request information about fallacies and their types or might end the exchange structure by agreeing with Botocrates. In case the user shows disagreement or states any feedback, Botocrates will make a *feedback* move and inviting the user to start a new topic. If the user asks a question about fallacies by initiating a new exchange structure, Botocrates will deal with this request as shown in the information-seeking floor.

Example of the set of tactics (purposeful moves) for addressing a probe-opinion floor initiated by users:

- If the user initiates (I) and performs an *Inform-Opinion* move, then Botocrates will re-initiate (RI) performing a *Why-question* move.
- If the user performs a *Give-Reason* move and it does not contain any potential fallacies, then Botocrates will close the floor by performing a *feedback* move and invite the user to start a new exchange structure by means of an *Ex-St-Opener* move.

User's action	The Wizard's action
IF: the user states her/his opinion (*Inform-Opinion*) followed by a support (*Give-Reason*) move and no potential fallacies were detected	**Then:** Botocrates will close the floor by performing a *feedback* move and starting a new exchange structure by means of an *Ex-St-Opener* move.
IF: the user's line of reasoning (*Give-Reason*) move contains a potential fallacy	**Then:** Botocrates will reply with a *Fallacy-Detection* move.
IF: the user replies to a *Fallacy Detection* move by e.g. *disagree* or *Feedback*	**Then:** Botocrates will perform a *feedback* move and invite the user to start a new exchange structure by means of an *Ex-St-Opener* move.
IF: the user replies to a *Fallacy Detection* move by performing an *agree* move.	**Then:** Botocrates will perform a *backchannel* move and invite the user to start a new exchange structure by means of an *Ex-St-Opener* move.
IF: the user initiates a new exchange structure at any stage of an opinion-stating floor.	**Then:** Botocrates will implement the process associated with the new and current floor

Table 40: Key actions for other possible events related to an opinion-stating floor

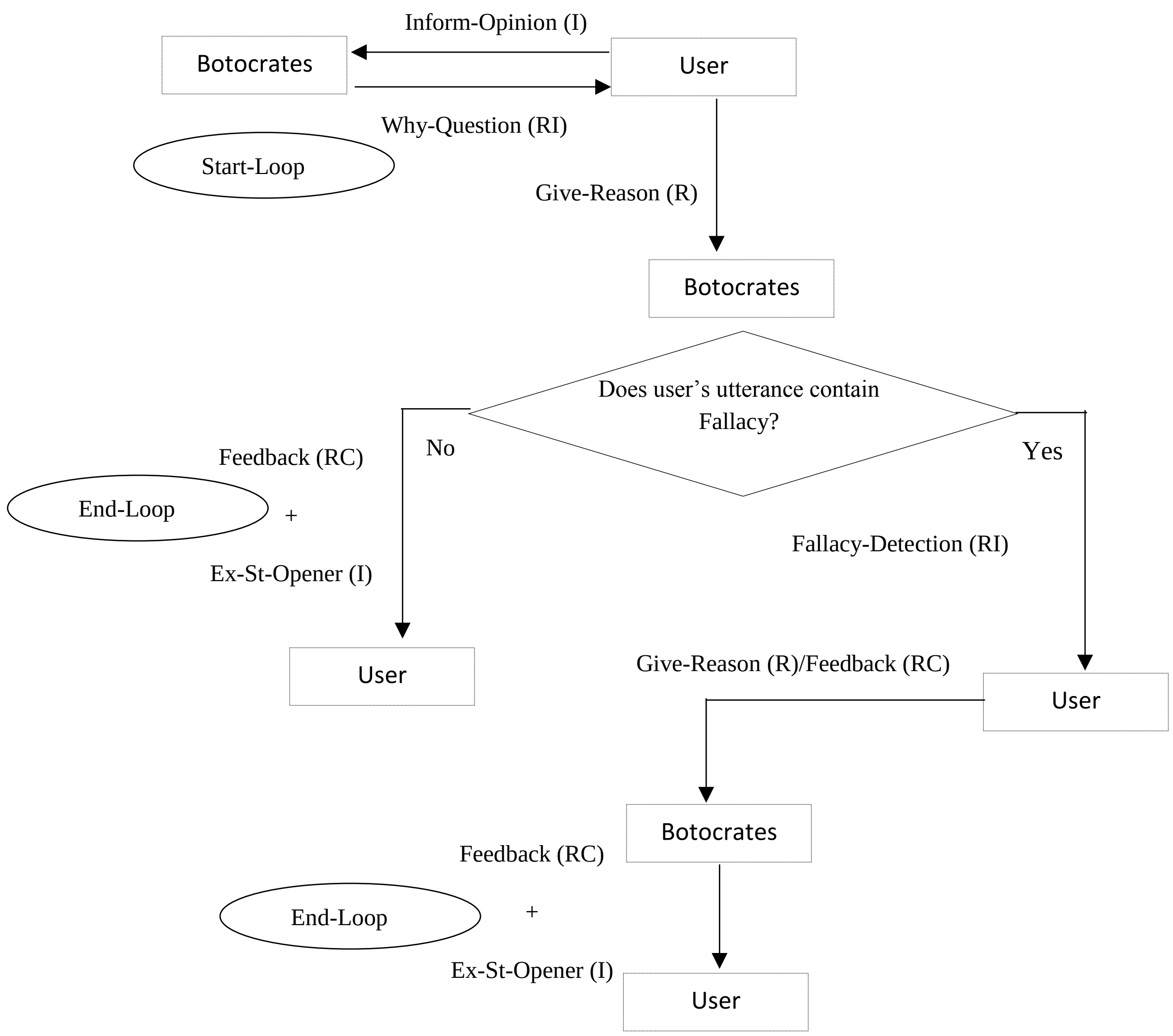


Figure 38: Flowchart represents a typical opinion-stating floor initiated by users

Challenge to explain floor

A *challenge to explain* floor refers to the floor initiated by Botocrates that aims at executing the *challenge to explain* process. A *challenge to explain* floor is divided in Botocrates' Academic Argumentation Bank (AAB) into two sub-floors: a) a simple *challenge to explain*, and b) a complex *challenge to explain*. A simple *challenge to explain* dialogue aims at encouraging users to state the minimal structure of argument (position and valid support). In such dialogue there is no a clear dispute where different positions might be taken. For example,

- *Do you believe using synchronous text-based chat helps students develop the language they are learning?*

- *Do you believe social presence is important in an online learning environment?*
- *Do you agree that online learning is now an important aspect of higher education?*

In Botocrates' AAB, there is only one position expected to be taken related to the above probe-opinion moves. In a simple *challenge to explain* floor, Botocrates simulates the sceptical role in the argumentation process. Botocrates in this process only raises a doubt about the taken position in order to encourage the user to state a valid line of reasoning. However, in the case where the user's position does not match the position in Botocrates' AAB, Botocrates will implement the process of complex *challenge to explain* and counter the user with a *counter* move that shows the stored position.

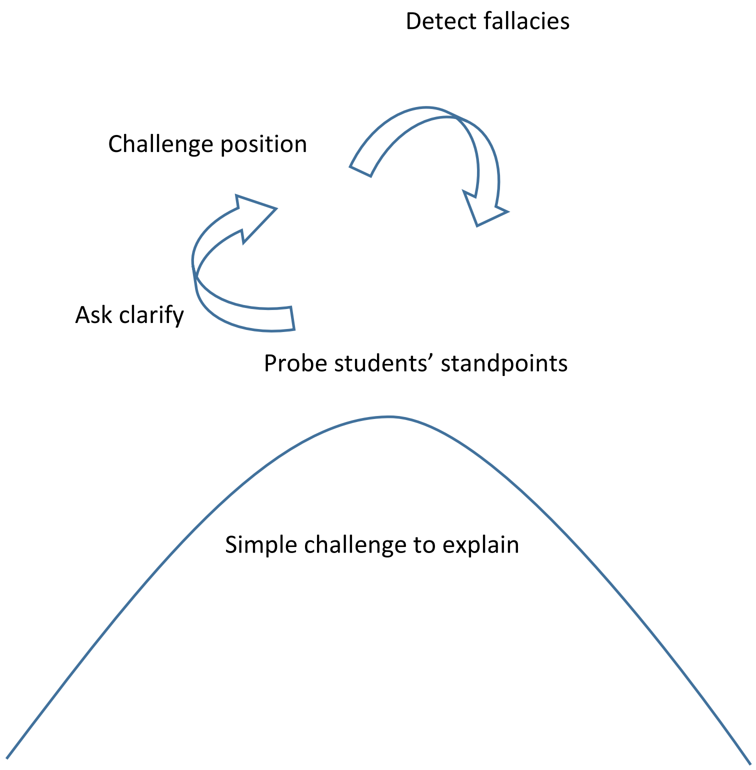


Figure 39: Simple challenge to explain process

On the other hand, in a complex *challenge to explain* dialogue, Botocrates creates a dispute situation as a result of the different positions stored in the AAB connected to the topic under discussion. For example,

- *Do you agree with Prensky's classification (2001) of Digital natives and Digital immigrants?*
- *What do you think of applying Salmon's model (2002) of online teaching and learning in a Blended Learning environment?*

A review of related literature to these probe-opinion moves revealed clear disputes and valid positions that can be taken.

> This is a matter of knowing the territory of the discipline, or at least of the topic. Once that territory is traversed via wide reading, reflection, discussion, and exploration of primary and secondary sources, the points of dispute tend to emerge.
>
> (Andrews, 2010, p.82)

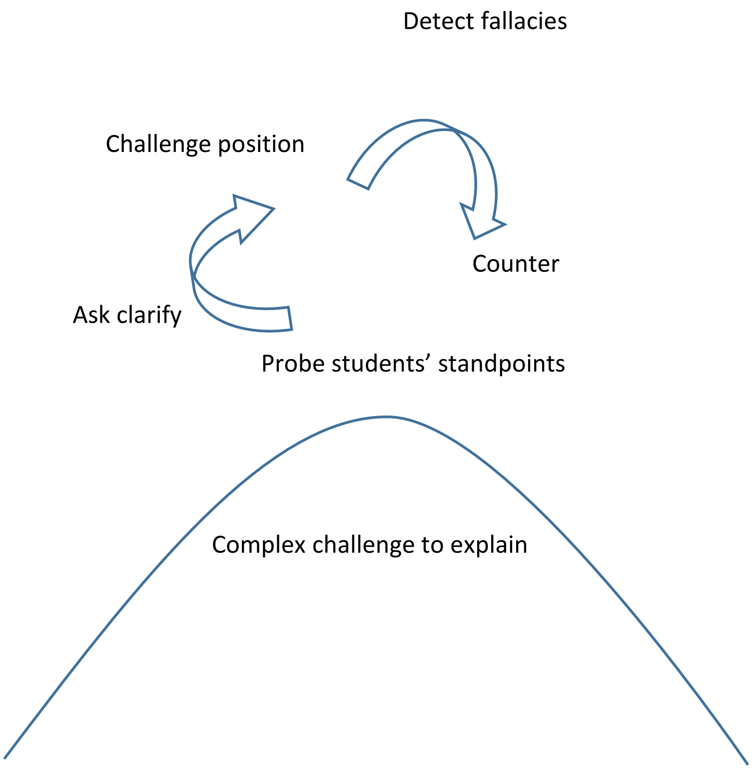


Figure 40: Complex challenge to explain process

It could be said that a simple *challenge to explain* process can be described as an asymmetrical dissent dialogue because Botocrates only raises a doubt by asking for valid support (Walton, 2006). In academic argumentation, students should support the stated position by adequate support (Soles, 2009, Andrews, 2010, Strongman, 2014). Students need to deal with sceptical audiences, readers, examiners, and supervisors (Richards and Miller, 2006, Livnat, 2012). On the other hand, complex *challenge to explain* processes can be referred to as symmetrical dispute dialogues where both parties (Botocrates and the user) hold different positions (Walton, 2006). In addition to challenging users to state their valid line of reasoning, Botocrates aims to encourage them to consider any counter-arguments which is an essential skill in the academic argumentation process (Andrews, 2010, Carroll, 2013).

The next sections present the practical implementation of the *challenge to explain* dialogue.

Simple challenge to explain

As illustrated earlier the area of a simple *challenge to explain* process is expected to have one position. For example,

Do you believe using synchronous text-based chat help students develop the language they are learning?

In Botocrates' AAB, there is only one position (*'yes'* or similar meaning such as *'I believe that it helps students', 'yes I do', 'of course' etc.*) stored in association with the above *probe-opinion* move. This position has sub-nodes of line of reasoning needed to support such a position.

Example of the sub-nodes stored in the AAB that support the above position (see acknowledgment of the sources used for Building Botocrates' AAB and KB):

- *It offers students the opportunities to practise the target language.*
- *It offers greater chance of interactions between learners.*
- *It allows learners to share ideas and receive Responses immediately in real-life chats.*
- *Through the written exchange, learners use the target language to negotiate both meaning and form.*
- *Social context is crucial for second language acquisition.*
- *It enables students to get immediate feedback and response from their peers.*
- *Learner re-examines and edits these text-based forms to make the interaction more meaningful and comprehensible.*

- *Shy students in traditional classrooms feel more motivated and comfortable to participate in online discussions* (see acknowledgment below)

Acknowledgment
Some of the contents of Botocrates' responses that appear in this example or in other examples throughout this chapter are quoted from related books & articles. The sources of these responses used to build Botocrates' KB or AAB were completely acknowledged in chapter 4 section *The Wizard of Oz* & in the list of references.

Expected scenario:

Botocrates invites the user to start a new topic and the user accepts Botocrates' invitation. Botocrates will ask a question to the user to elicit her/his opinion. The user replies by stating the position according to her/his belief regarding the issue under discussion. If the stated position matches the position in Botocrates' AAB, Botocrates will ask the user about the motive or the rationale for the stated position. The user is expected to reply by stating the line of reasoning connected to the taken position. If there are no potential fallacies detected, Botocrates will respond by performing a feedback and inviting the user to start a new topic. In case the user's position does not match the position stored in AAB, Botocrates will ask a clarification question in order to encourage the user to articulate the taken position. If the user's position is not identified in the second round and does not match the position in AAB, after asking for the reason or support for the stated position, Botocrates will counter the user with the position stored in the AAB and its support. If the user defends the taken position against Botocrates' attack, Botocrates will respond by giving a feedback and invite the user to start a new topic. If the user agrees or shows acknowledgment of the other side of the argument by performing an *agree* move, Botocrates will perform a backchannel move and invite the user to start a new topic.

Example of the set of tactics (purposeful moves) for addressing a simple *challenge to explain* exchange structure:

- Botocrates initiates (I) performing an *Ex-St-Opener* move, if the user accepts Botocrates' invitation, then Botocrates will initiate (I) by making a *probe-opinion move.*

- If the user performs an *inform-opinion* move and the stated position matches the position stored in Botocrates' AAB, then Botocrates will execute a *why-question* move.
- If the user replies to Botocrates' *why-question* move and states the line of reasoning by means of a *Give-Reason* move, and it does not contain any potential fallacies, then Botocrates will close the floor by performing a *feedback* move and invite the user to start a new exchange structure by means of an *Ex-St-Opener* move.

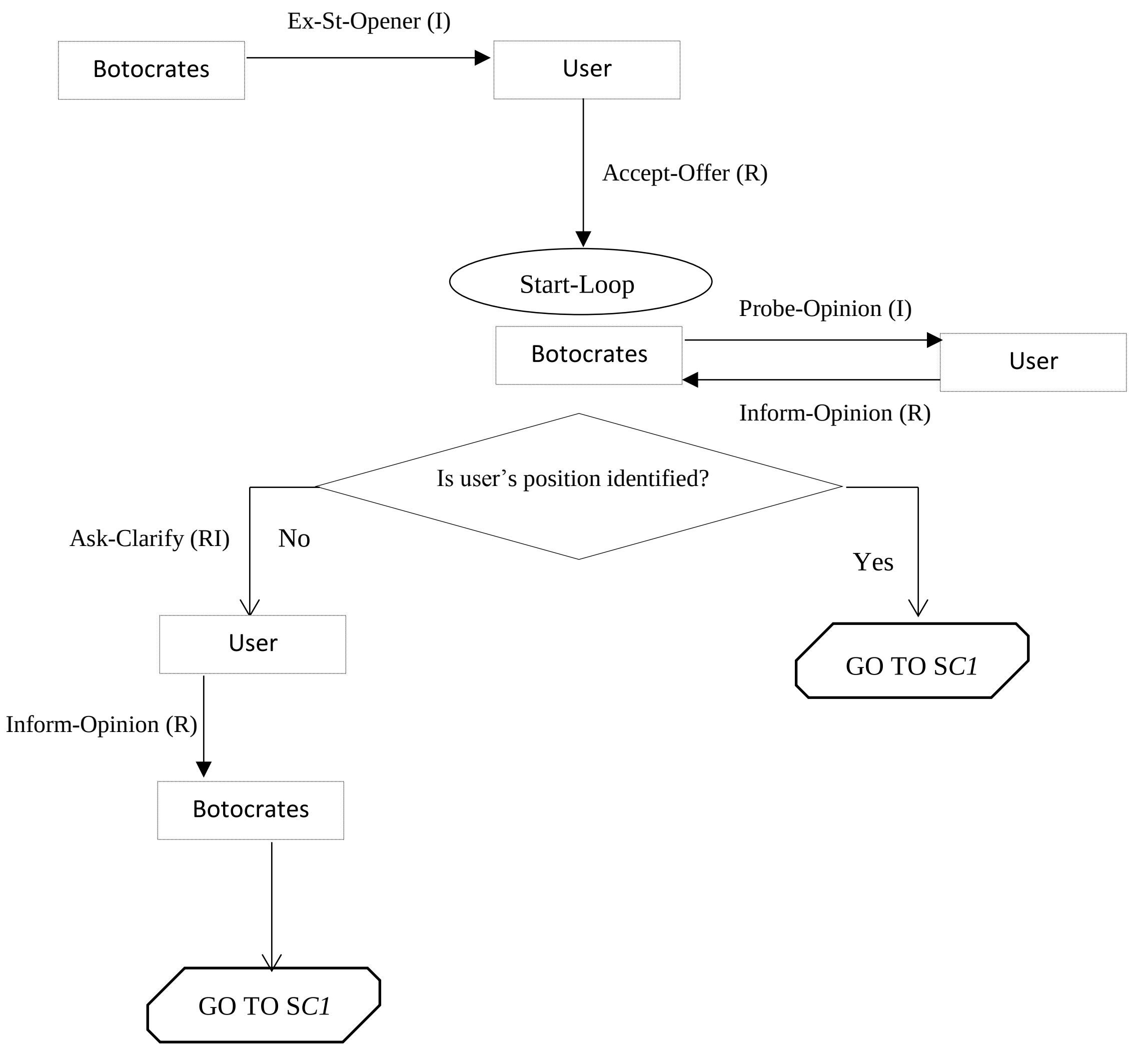


Figure 41 (part one)//*See the other part of the diagram in the next page*

SC1:

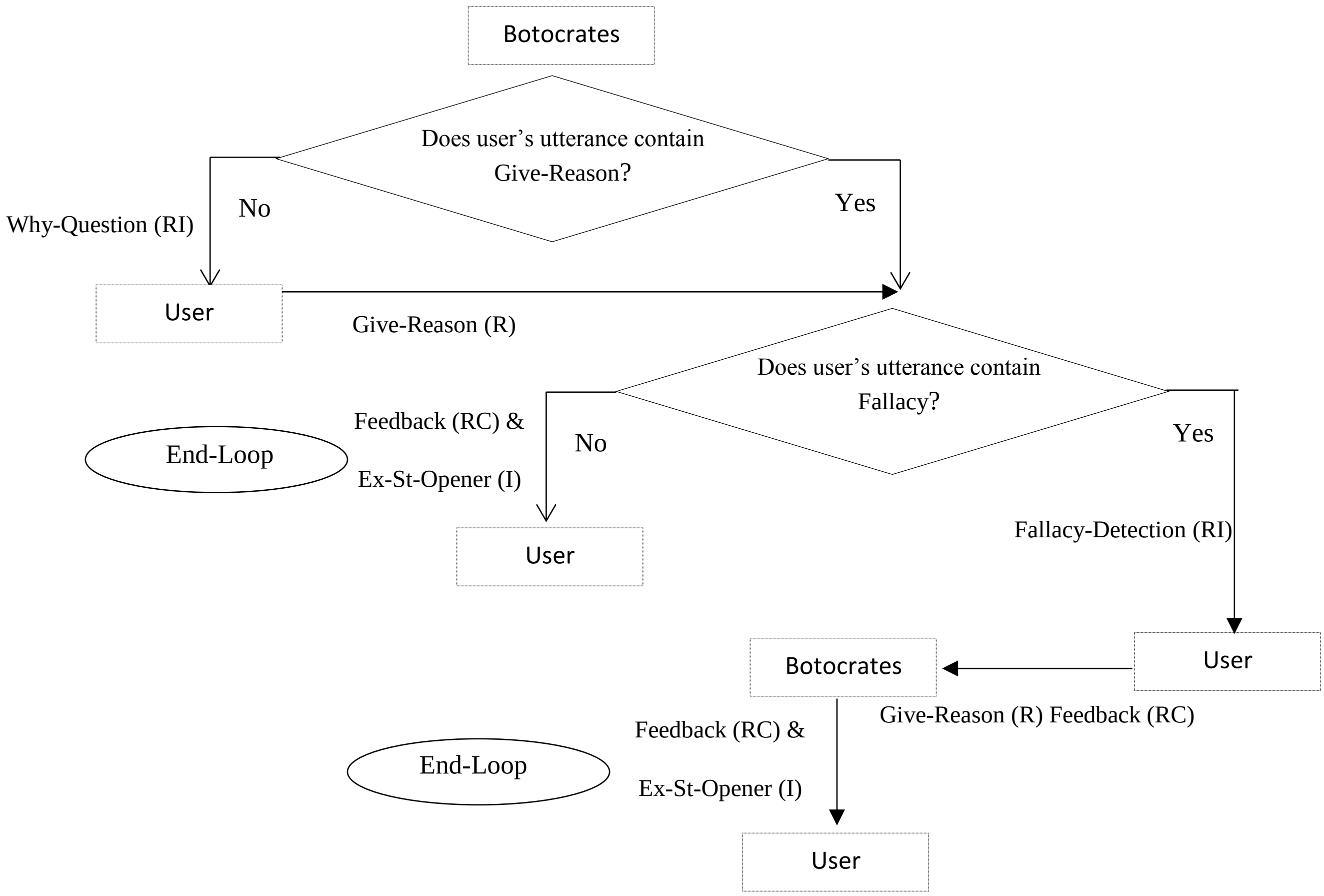


Figure 41: Flowchart represents a typical simple challenge to explain floor

An example shows a case where the user's position matches the position in Botocrates' AAB

Botocrates: *Do you believe using synchronous text-based chat helps students develop the language they are learning?*

X: *yes, it is a good tool for supporting language learning and teaching*

Botocrates: *Why do you think that?*

X: *it enables the learner to practise the language and interact with their peers*

Botocrates: *That sounds good. Would you like to ask me a question or should I select a topic of my area of interest?*

Example 43: One of the expected scenarios where the user's position matches the position in Botocrates' AAB in a simple challenge to explain floor

Another example shows a case where the user's position does not match the position in Botocrates' AAB

Botocrates: *Do you believe using synchronous text-based chat helps students develop the language they are learning?*

X: *NO*

Botocrates: *Why do you think that?*

X: X is expected to perform a *Give-Reason* move

Botocrates: *Yes but it offers students the opportunities to practise the target language. It offers a greater chance of interactions between learners. It allows learners to share ideas and receive responses immediately in real-life chats. Through the written exchange, learners use the target language to negotiate both meaning and form.*

X: X is expected to reply either to agree, disagree and justify or to give feedback on Botocrates' previous utterance

Botocrates: Feedback move & ES-St-Opener "*Would you like to ask me a question or should I select a topic of my area of interest?*"

Example 44: One of the expected scenarios where the user's position did not match the position in Botocrates' AAB in a simple challenge to explain floor

User's action	The Wizard's action
IF: the user asks a clarification question regarding some of the terms mentioned in Botocrates' *probe-opinion* move	**Then:** Botocrates will perform a *Give-Info* move followed by the same *probe-opinion* move
IF: the user responds to Botocrates' probe-opinion move by stating *" I do not know"* or *"I am not sure"*	**Then:** Botocrates will perform a *Hint* move and provide information related to the particular topic under discussion to help the user take a certain position, followed by the same *probe-opinion* move
IF: the user states her/his opinion (*Inform-Opinion*) followed by a support (*Give-Reason*) move and no potential fallacies were detected	**Then:** Botocrates will close the floor by performing a *feedback* move and starting a new exchange structure by means of an *Ex-St-Opener* move.
IF: the user's line of reasoning (*Give-Reason*) move contains a potential fallacy	**Then:** Botocrates will reply with a *Fallacy-Detection* move.

IF: the user replies to a *Fallacy Detection* move by e.g. *disagree* or *Feedback*	**Then:** Botocrates will perform a *feedback* move and invite the user to start a new exchange structure by means of an *Ex-St-Opener* move.
IF: the user replies to a *Fallacy Detection* move by performing an *agree* move.	**Then:** Botocrates will perform a *backchannel* move and invite the user to start a new exchange structure by means of an *Ex-St-Opener* move.
IF: the user initiates a new exchange structure at any stage of a simple *challenge to explain* floor.	**Then:** Botocrates will implement the process associated with the new and current floor
IF: the user's position does not match the position stored in Botocrates' AAB	**Then:** after performing a *why-question*, move AND no potential fallacies are detected, Botocrates will perform a *counter* move and present the other side of the argument. If the user's position is related and valid, Botocrates' AAB should be expanded to include the new position. This is the duty of the botmaster or the designer (Wallace, 2003)
IF: the user replies to a *counter* move by performing an *agree* move.	**Then:** Botocrates will perform a *backchannel* move and invite the user to start a new exchange structure by means of an *Ex-St-Opener* move.

Table 41: Key actions for other possible events related to simple challenge to explain floor

Complex challenge to explain floor

A complex *challenge to explain* floor refers to the type of *challenge to explain* that includes a dispute situation. The complex *challenge to explain* floor is expected to take place in the areas where different positions can be adopted. In Botocrates' AAB, a complex *challenge to explain* floor consists of two or more positions and each position has its own sub-nodes of support. For example,

- *Do you agree with Prensky's classification (2001) of Digital natives and Digital immigrants?*

In response to the above *probe-opinion* move, the user may agree, or disagree with this classification or the user may take a position in between (either partly agree or partly disagree). As we can notice the complex *challenge to explain* process is rooted in the area of dispute. Let us look at the some of the nodes of positions and sub-nodes of support connected to each position.

- *Do you agree with Prensky's classification (2001) of Digital natives and Digital immigrants?*

Node A =Position one: agree

Sub-nodes of support

A1= "The new generation is more surrounded by technology than the previous generations.

A2=The cognitive style of digital immigrants and digital natives may differ regarding their thought processes.

A3=People who grow up with technology are more likely to be comfortable with it than if they do not.

A4=Digital Immigrants had to learn and adapt to using emerging technologies rather than seeing them as natural tools as part of their given world"

Acknowledgment
Some of the contents of Botocrates' responses that appear in this example or in other examples throughout this chapter are quoted from related books & articles. The sources of these responses used to build Botocrates' KB or AAB were completely acknowledged in chapter 4 section The Wizard of Oz & in the list of references.

Node B =Position two: disagree

Sub-nodes of support

B1= "This classification is oversimplified, it lacks an evidence base.

B2=The classification is binary, it ignores the grey areas, it is based on whether people are digital immigrants or digital natives.

B3=The classification did not consider the gradual evolution of technology.

B4= We might find some children in developing countries who lack the abilities to use technology.

B5=In some cultures teachers and students are equally familiar or unfamiliar with technologies."
(See the acknowledgment above)

Expected scenario:

Botocrates invites the user to start a new exchange structure and the user accepts Botocrates' offer. Botocrates will probe the user's opinion by asking a question to elicit her/his opinion. The user answers by informing Botocrates about the taken position that represents her/his evaluation of the issue under discussion. If the taken position matches one of the positions stored in Botocrates' AAB, Botocrates asks the user for support that leads the user to adopt the particular position. The user is expected to answer and state the line of reasoning related to the taken position. If no potential fallacies are detected, Botocrates will respond by performing a counter move (*yes but*) that consists of some of the justifications of the other side of the argument (counter-argument) by stating some of the counter sub-nodes. If the user defends the taken position against Botocrates' attack, Botocrates will make a feedback move and invite the user to start a new topic.

If the user's position does not match one of the positions stored in the AAB, Botocrates will ask a clarification question in order to encourage the user to articulate her/his position. If the user's position does not match any one of the positions in the AAB after the clarification question, Botocrates will ask the user to state her/his support. After the user responds by a *Give-reason* move and no fallacies are detected, Botocrates will randomly select a certain position to counter the user with one of the positions stored in the AAB and its support. If the user defends the taken position against Botocrates' attack, Botocrates will respond by giving a feedback and inviting the user to start a new exchange structure. If the user shows agreement and acknowledgment of the counter-argument stated by Botocrates, Botocrates will perform a backchannel move and invite the user to start a new exchange structure.

Example of the set of tactics (purposeful moves) for addressing a complex *challenge to explain* exchange structure:

- Botocrates initiates (I) performing an *Ex-St-Opener* move, if the user accepts Botocrates' invitation, then Botocrates will initiate (I) by making a *probe-opinion move.*

- If the user performs an *Inform-opinion* move and the stated position matches one of the positions stored in Botocrates' AAB, then Botocrates will execute a *Why-question* move.
- If the user replies to Botocrates' *Why-question* move and states the line of reasoning by means of a *Give-Reason* move, and it does not contain any potential fallacies, then Botocrates will reply by performing a *Counter* move.
- If the user defends the taken position against by making a *Defend-attack* move, Botocrates will respond by making a feedback move followed by an *Ex-St-Opener* move.
- In case the user agrees or acknowledges the limitation of the initial position, Botocrates will respond by performing a *backchannel* move followed by an *Ex-St-Opener* move.

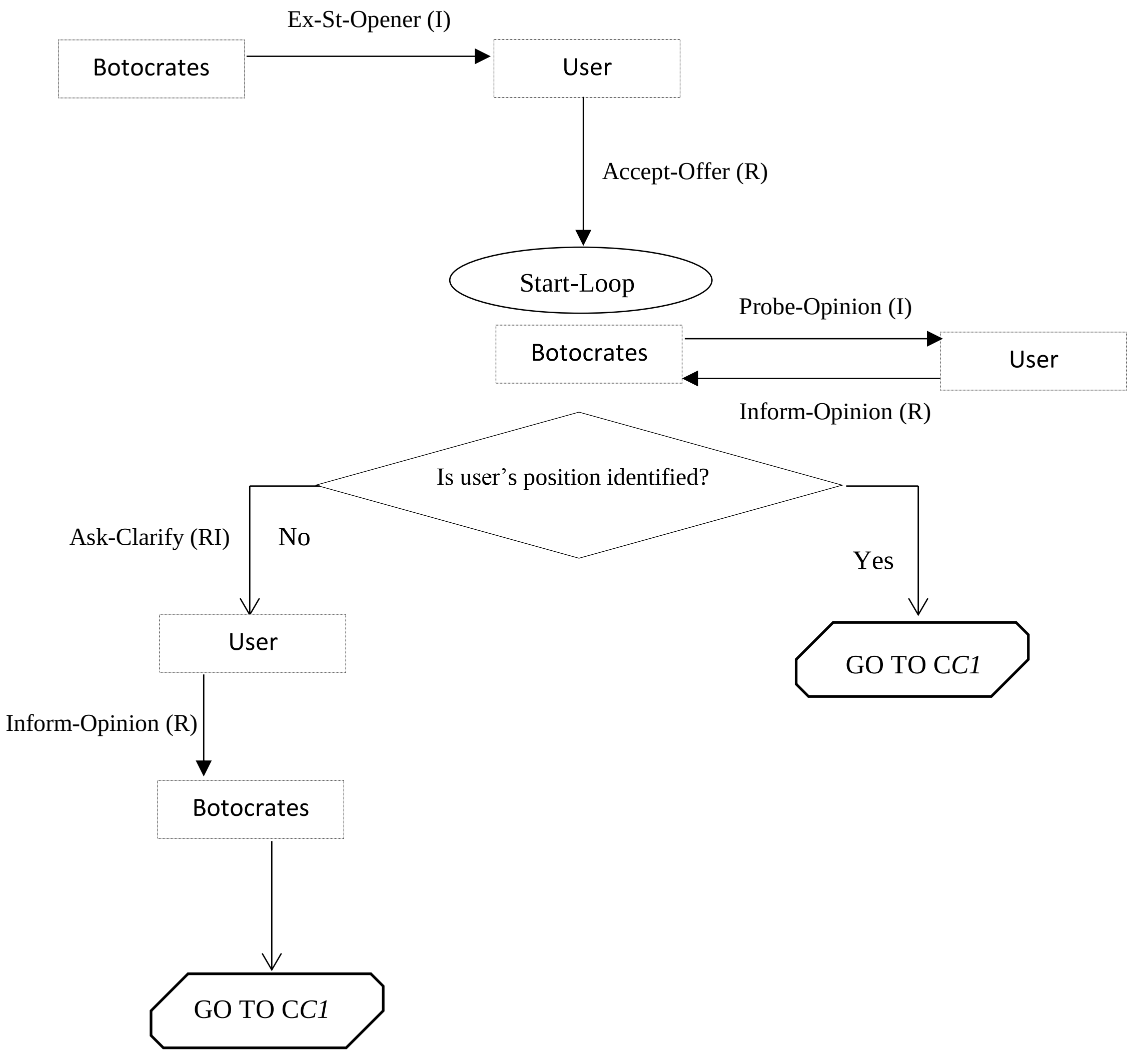
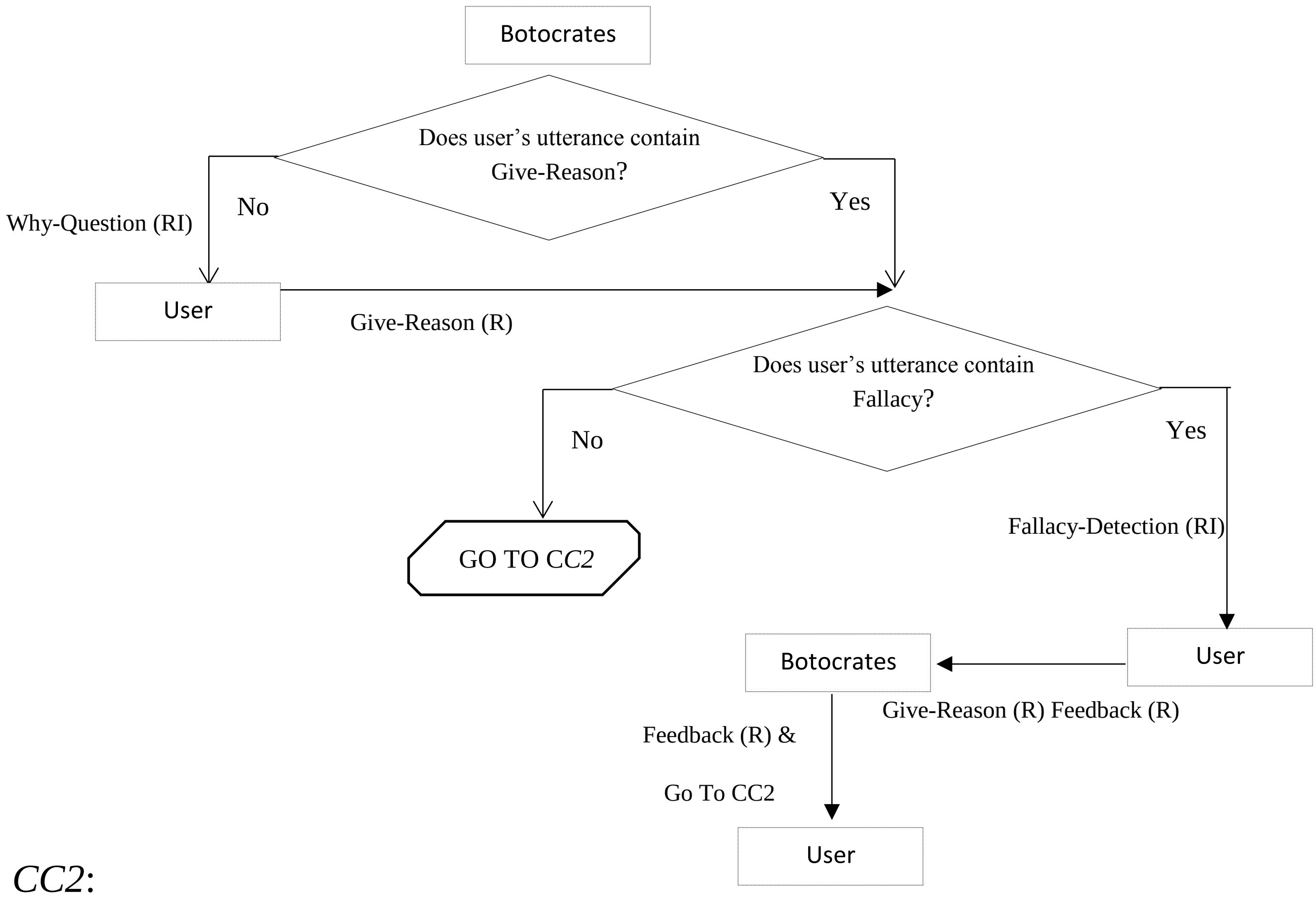


Figure 42 (part one)*//See the other part of the diagram in the next page*

CC1:



CC2:

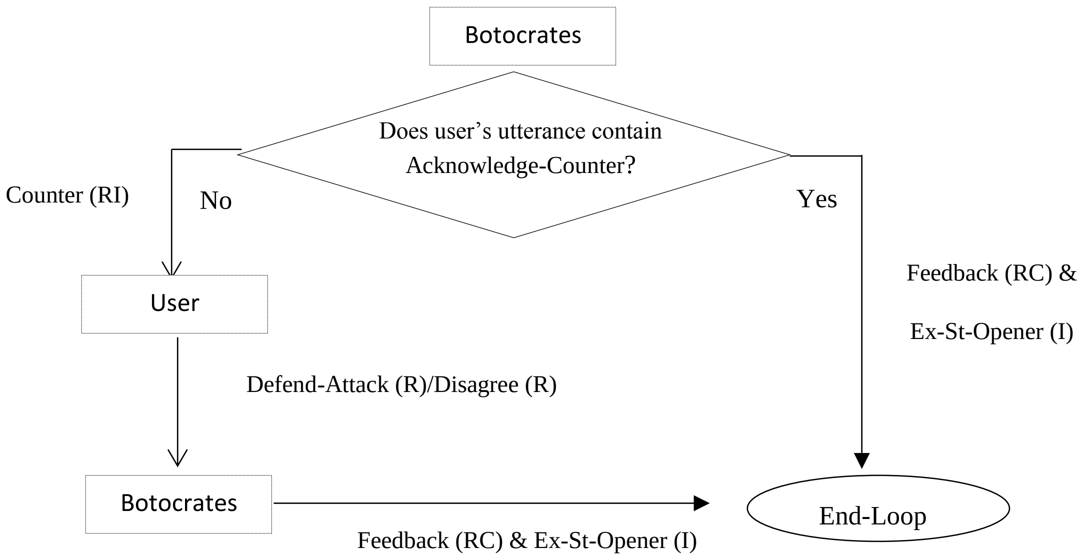


Figure 42: Flowchart represents a typical complex challenge to explain floor

Let us look at the examples below:

Botocrates: *Do you agree with Prensky's classification (2001) of Digital natives and Digital immigrants?*

X: *yes*

Botocrates: *Why do you think that?*

X: X is expected to state the line of reasoning connected to a Yes position.

Botocrates: *Yes but the classification is binary. It ignores the grey areas, it is based on whether people are digital immigrants or digital natives. In some cultures teachers and students are equally familiar or unfamiliar with technologies.*

X: x is expected to perform a *Defend-attack* move or *Agree*, *Disagree* or only evaluate Botocrates' previous utterance by making a *feedback* move.

Botocrates: Feedback move & *ES-St-Opener* "*Would you like to ask me a question or should I select a topic of my area of interest?"*

Example 45: One of the expected scenarios of a complex challenge to explain floor

User's action	The Wizard's action
IF: the user asks a clarification question regarding some of the terms mentioned in Botocrates' *probe-opinion* move	**Then:** Botocrates will perform a *Give-Info* move followed by the same *probe-opinion* move
IF: the user responds to Botocrates' probe-opinion move by stating *" I do not know"* or *"I am not sure"*	**Then:** Botocrates will perform a *Hint* move and provide information related to the particular topic under discussion to help the user to take a certain position, followed by the same *probe-opinion* move
IF: the user states her/his opinion (*Inform-Opinion*) followed by a support (*Give-Reason*) move and no potential fallacies are detected	**Then:** Botocrates will perform a *counter* move.
IF: the user's line of reasoning (*Give-Reason*) move contains a potential fallacy	**Then:** Botocrates will reply with a *Fallacy-Detection* move.

IF: If the user replies to a *Fallacy Detection* move by e.g. *disagree* or *Feedback*	**Then:** Botocrates will perform a *feedback* move and perform a *counter* move.
IF: the user replies to a *Fallacy Detection* move by performing an *agree* move.	**Then:** Botocrates will perform a *backchannel* move followed by a *counter* move.
IF: the user initiates a new and unrelated exchange structure at any stage of a complex *challenge to explain* floor.	**Then:** Botocrates will implement the process associated with the new and current floor
IF: the user's position does not match one of the positions stored in Botocrates' AAB	**Then:** after performing a *why-question*, move AND no potential fallacies are detected, Botocrates will perform a *counter* move and randomly present a counter-argument connected to the topic under discussion. If the user's position is related and valid, Botocrates' AAB should be expanded to include the new position. This is the duty of the botmaster or the designer (Wallace, 2003)
IF: If the user replies to a *counter* move by performing an *agree* move.	**Then:** Botocrates will perform a *backchannel* move and invite the user to start a new exchange structure by means of an *Ex-St-Opener* move.

Table 42: Key actions for other possible events related to complex challenge to explain floor

Some other conversational events that might occur during the chat:

User's action	The Wizard's action
IF: the user's utterance is not recognized or abandoned.	**Then:** Botocrates will perform a *Request-formulate* move *"Something went wrong! Can you reformulate your sentence?"*
IF: the user abandons and leaves the chat at any time	**Then:** No further action needed
IF: the user initiates any turn that is not relevant to the current exchange structure AND it does not belong to any type of floor (social convention, information-exchange, opinion-exchange and *challenge to explain*)	**Then:** Botocrates will respond by performing a *Backchannel* move *"Uh-huh"* followed by a *Direct* move "*Let us chat about topics related to the Module EDUC5256M"* and an *Ex-St-Opener* move "*Would you like to ask me a question or should I select a topic of my area of interest?"*.

Table 43: Key actions for other possible events that might occur during the chat

As illustrated above, the wizard at this stage of the research will rely on the above tactics and the data stored in the KB and AAB. In addition, the wizard will perform feedback moves using the 'canned' feedback moves according to the current circumstance of the dialogue. For example:

- If the user states the taken position followed by *Give-reason* moves and acknowledge-counter move, then Botocrates will reply *"That sounds like a valid argument", "That sounds good".*
- If the user defends her/his position against the attack stated by Botocrates, then Botocrates will state *"That sounds interesting"*
- If the user performs only a *Disagree* move in the previous turn, then Botocrates will state *"Your disagreement should be based on reason"*

6.6 Conclusion

Botocrates' approach for promoting students' skills and academic argumentation skills is based on the assumption that students' engagement in repeated and constant cycles of reflective thinking could lead to the desired outcomes. The new approach of Botocrates (*challenge to explain* dialogue) highlights the importance of the need to offer students situations where the internalisation of the processes of argumentation could be obtained. During students' engagement in the *challenge to explain* process, Botocrates' cognitive train will frequently pass through different cognitive stages so that students will be familiar with them. Botocrates can be classified as a task-oriented pedagogical agent that has a set of tasks and sub-tasks needed to be performed. In order to achieve the final goal of interaction, the two main tasks of Botocrates were identified: a) providing students with information related to the domain of knowledge, and b) engaging students in the *challenge to explain* process including probing their opinions, asking clarification questions, challenging students' opinions, detecting any potential fallacies and countering students with any counter-arguments related to the topic under discussion. The initial expectation of the interaction is that students ask for information related to the domain of knowledge and Botocrates in turn provides the required information and then directs the chat towards the process of the *challenge to explain* dialogue. Reaching the final goal of the dialogue requires both key components (Knowledge Base KB and Academic Argumentation Bank AAB) and a set of strategic manoeuvres during the interaction. While the KB contains the information related to the domain of knowledge, AAB consists of the areas of the *challenge to explain* process. Each area of the *challenge to explain* process is designed to encompass the nodes of positions and sub-nodes of support linked to each position.

Even though it is difficult to anticipate the entire users' conversational behaviours during the interaction with Botocrates before the implementation of the WOZ experiments, initial scenarios that may occur were proposed. The initial design was created to address four types of floor: a) social conventions floor, b) information-exchange floor, c) probe-exchange floor, and d) *challenge to explain* floor. While the first three floors can be described as user-initiation floors, the last one (*challenge to explain*) is the Botocrates-initiation floor. In such a mixed initiative dialogue both the user and Botocrates will be able to direct the flow of the dialogue. The moves that represent the communicative actions needed for addressing each dialogue floor were identified. According to the current circumstance of interaction the dialogue strategies are presented in a set of tactics.

The next chapter explores what happens when users interact with Botocrates. The execution of the proposed scenarios and dialogue strategies using the WOZ experiments will help in identifying the actual users' conversational behaviours which in turn will enable better refinement of the initial version.

Chapter Seven: The Evaluation of Botocrates' prototype (stage two)

Analysis and Discussion of findings

7.1 Introduction

The aim of this chapter is to present the findings from the data analysis carried out for evaluating the effectiveness of Botocrates' prototype. The presentation of the results are followed by a detailed discussion of the interpretations of these findings and their practical implications on the design of Botocrates' communicative actions. The sources of the data gathered for achieving the objectives in relation to this stage of the research study were: a) the logs collected from the chats performed using WOZ experiments, and b) interviews. The total numbers of the analysed logs that appear throughout this chapter is 7 transcripts extracted from two phases of the WOZ experiments. While the goal of the first phase of the WOZ experiments was to test the initial version of Botocrates' prototype, the second phase aimed at conducting the main evaluation of the efficiency of Botocrates' interactional behaviours. Each participant who took part in the WOZ experiments was immediately interviewed after the chat session (total 7 participants). The rationale for the analysis of the logs extracted from the experiments is to examine the extent to which Botocrates is effective in completing the tasks, including users' engagement in the argumentation process. Analysing the logs also enables me to detect any flaws in the initial design. In addition, the use of interviews can uncover users' feelings and levels of satisfaction about the interactions with Botocrates.

This chapter is divided into two main sections: a) the pilot experiments, and b) the main evaluation. The pilot experiments section clarifies the modifications made to the initial design as a result of conducting the initial set of the WOZ experiments. The second section (the main evaluation) is further divided into two subsections: a) the analysis of the results followed by b) the discussion of the research findings. The analysis of the chat transcripts was carried out at different levels: exchange structure, conversational move and conversational floor analysis. The thematic analysis was adopted in order to identify the patterns that emerged from interview data related to the objectives of the research. Throughout this chapter, the description of the findings is supported by the use of quotations and evidence drawn from the logs of the WOZ experiments and interviews. The discussion section includes the interpretations of the findings from the evaluation stage and its implications for Botocrates' brain.

7.2 The Pilot experiments

This section aims to introduce the development and the modifications made to the initial version of Botocrates' prototype and dialogue strategies, presented in chapter six, in the light of the findings from the pilot experiments. The pilot experiments can be seen as the first set of the WOZ experiments (Cypher and Halbert, 1993). The motive for carrying out the pilot experiments before implementing the main evaluation of Botocrates' brain was to increase the usability and the effectiveness of the initial design (Ruttkay and Pelachaud, 2004, Lisowaska and Armstrong, 2007, Yaghoubzadeh et al, 2013). Before the real evaluation is conducted with large numbers of participants, checking the functionality of the first version with a few users is indispensable because it helps in identifying shortcomings and the limitations of the proposed version (Gibbon et al, 1998, Melichar and Cenek, 2006).

The number of users who participated in these initial experiments were 2. The two participants were asked to chat with Botocrates (the wizard) and they were interviewed immediately after the experiments. Note that the descriptions and the justifications of this process is fully explained in chapter 4 section *Procedures of recording and collecting wizard of Oz data*.

As we can see in *Table 44*, during the two sessions of the pilot experiments, the total number of conversational moves made by Botocrates (the wizard) was 73. The accuracy of the wizard when implementing the proposed dialogue strategies and tactics represented 90.4% (total correct moves=66). The findings suggest that the wizard must undertake extensive training sessions in order to decrease the number of wrong conversational moves made during the chats. Wrong execution occured when the wizard mistakenly did not follow the dialogue strategies and tactics proposed in chapter 6, see section *6.5 Scenario and dialogue modelling*.

NO	Session	The accuracy of the wizard's moves				Total moves
		Correct Moves		Wrong moves		
1	HIS	28	90.3%	3	9.7%	31
2	RAH	38	90.4%	4	9.6%	42
Total		66	90.4%	7	9.6%	73

Table 44: The accuracy of the wizard's moves during the pilot experiments

The transcript below extracted from the pilot experiments shows an example of a wrong execution made by the wizard. As we can see in the last contribution made by Botocrates, the wizard did not correctly execute the closing stage of the simple *challenge to explain* processes (The feedback move was not performed).

Botocrates: *Do you agree that online learning is now an important aspect of higher education?*
RAH: *Yes. I sure do.*
Botocrates: *Why do you think that?*
RAH: *Because online learning provides easy access to students from around the world and opens horizons for them with an endless variety of resources available at their disposal anytime and anywhere.*
Botocrates: *would you like to ask me a question or should I select another topic of my area of interest?*

Example 46: Wrong execution of the proposed strategies

Based on the evidence gathered from the pilot experiments, the following points explain the modifications and changes carried out on the initial design of Botocrates' brain before implementing the main evaluation. In addition, these points include the justifications and the circumstances that led to making such changes.

1. **Botocrates' knowledge base should consist of a comprehensive and larger knowledge base in order to increase users' satisfaction.**

The findings suggest that the KB in Botocrates' brain needs to be sufficiently large in order to succeed in passing required information to users. As *Table 45* and *Figure 43* show, 41% of the total numbers of *Give-info* moves were unsuccessful ones because of the limited data stored in the knowledge base of Botocrates. During the pilot study sessions, Botocrates made 17 *Give-info* moves but only 10 moves were successful in terms of satisfying users' goals of interactions.

NO	Session	Total numbers of Give-Info	Successful Give-info		Answer-Not-Found	
1	HIS	8	5	62.5%	3	37.5%
2	RAH	9	5	55.5%	4	44.5%
	Total	17	10	59%	7	41%

Table 45: The total numbers of Botocrates' Give-Info moves during the pilot experiments

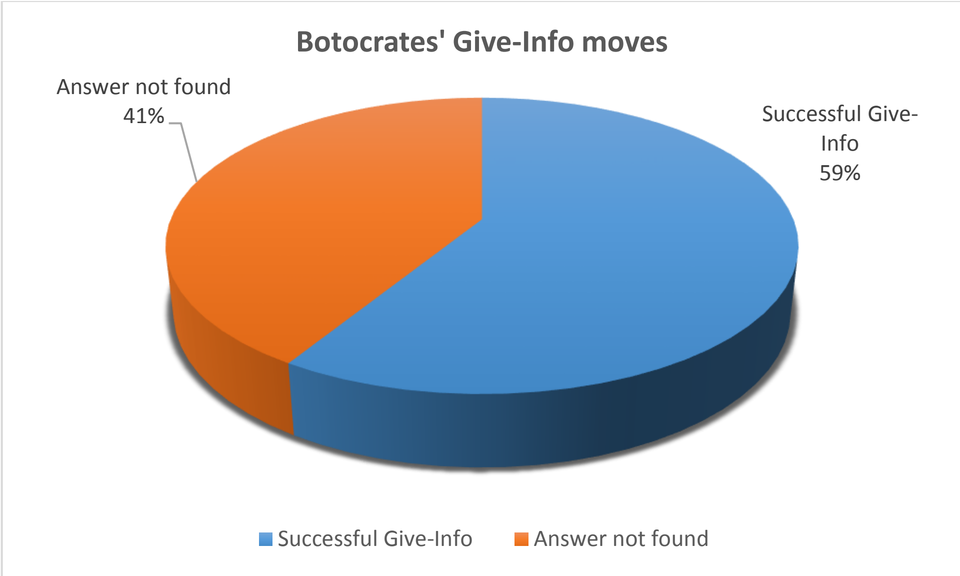


Figure 43: Successful and unsuccessful Give-Info moves during the pilot experiments

It could be said that the availability of sufficient data in the knowledge base plays a crucial role in increasing users' satisfaction. For example, the participant RAH who rated his satisfaction as 6 out 10 reported the failure of Botocrates in providing the answers to some questions related to the domain-specific knowledge among the unsuccessful experiences when chatting with Botocrates, as he pointed out:

"*There were some questions which the chatbot was not able to answer and he gave an automated reply*".

Also HIS, who rated his satisfaction as 7 out of 10, stated:

"*Although the chat increased my knowledge about some topics, it could not answer all my questions… in some questions the chatbot could not provide me with any information… it is supposed to answer all the questions that I need to ask*".

These results are consistent with earlier similar studies which confirm the relationship between users' satisfaction and agents' satisfactory answers, which should lead to achieving the goal of interactions (Walker et al, 2001, Zhang et al, 2003, Quarteroni and Manandhar, 2007, Abu Shawar and Atwell, 2007b, Hastie, 2012).

2. **Botocrates needs to take into account some phatic questions in order to increase the interactivity.**

The first design of Botocrates' KB highlights the importance of two categories of knowledge needed to be stored in Botocrates' KB: a) general knowledge that is not related to subject matter-knowledge and b) domain-specific knowledge (see chapter 6, section *Main Task 1: Information-seeking task*). These two types are important to ensure the interactivity between Botocrates and potential users. However, the first version of the design did not take into account some of the possible phatic questions that might be posted by users e.g. users asked phatic questions such as '*how old are you?' 'Are you married?'* For example:

RAH: *Are you married?*

Botocrates: *Oops I have no answer, sorry my brain is under construction. I hope next time you will find the answer as the botmaster is continuously feeding my brain.*

Example 47: A phatic question

Even though such answers may not contribute to promoting information exchange related to the domain of knowledge, it seems that it may affect users' satisfaction with Botocrates. For instance, RAH stated:

"He could not respond to me when I asked him personal questions. These questions are expected when communicating with someone".

Hence, there is a need to address this aspect of the dialogue in order to increase users' satisfaction. Users' expectations about the system should be taken into consideration in order to increase the level of users' satisfaction, which contribute to their final evaluation of the proposed system (Vermeulen et al, 2010, Lockelt, 2011). After the pilot experiments, the Knowledge Base (KB) was modified and updated to contain some possible answers for such questions. For example:

(48.1)

X: *are you married?*

Botocrates: *No I am single. I am interested only in Knowledge*

(48.2)

X: *where do you live?*

Botocrates: *I live in the School of Education at the University of Leeds*

Example 48: Expected scenarios for phatic questions

3. Botocrates should encourage users to give a further explanation.

Although the initial design of Botocrates includes a *why-question* move that encourages a user to state a defence of a line of argument, it seems that in some events asking for further explanations of the rationale behind the taken positions is required. Let us look at the examples below quoted from the logs of the pilot experiment:

(49.1)

Botocrates: *Do you believe using synchronous text-based chat helps students develop the language they are learning?*

HIS: *Yes it may help in many ways… it keeps student associated with the language.*

Another example,

(49.2)

Botocrates: *Do you believe using synchronous text-based chat helps students develop the language they are learning?*

RAH: *Yes I do. I think it helps them practise the language.*

Example 49: The need for Ask-explain moves

Using a question such as '*Could you explain more*?' in reply to these responses stated by HIS and RHA could help them to develop their lines of reasoning (Paul and Elder, 2006a, Paul, 2009, Aveyard et al, 2011, Arp and Watson, 2015). Promoting users' critical thinking and argumentation skills requires encouraging the exploration of the rationale of the taken position by requesting sufficient evidence or support (Jones-Devitt and Smith, 2007, Girod, 2014, Hunter, 2014). However, the question that might be raised here is how Botocrates could know whether there is a need to ask for a further explanation or not? To address this challenge, Botocrates' dialogue strategies were reviewed to implement a condition which must be achieved, and if the condition was not achieved Botocrates would reply to users' *Give-Reason* moves by perfoming an *Ask-explain* move '*Could you explain more*? The condition is that a user must state at least two or more sub-nodes of evidence from the sub-nodes of support in the Academic Argumentation Bank (AAB) connected to the taken position, otherwise Botocrates will reply to the user's *Give-Reason* move by performing an *Ask-explain* move. *Figure 44* illustrates the structure, in Botocrates' AAB, of the sub-nodes of support (A1, A2…An) & (B1, B2…Bn) connected to the node of positions (P1, P2) respectively. Chapter 6, section *challenge to explain*, illustrates the structure of the nodes of positions and the sub-nodes of support in the AAB with examples.

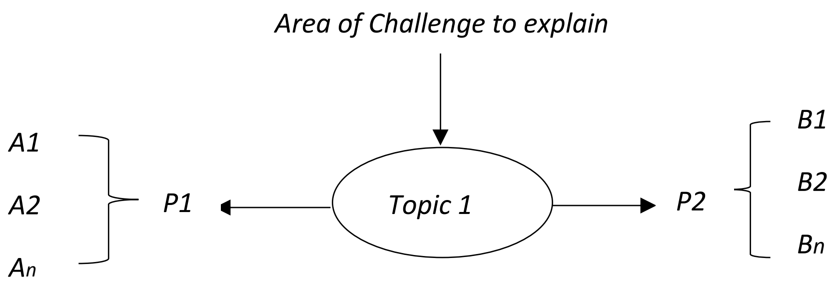


Figure 44: Structure of the node of position and the sub-nodes of support in Botocrates' AAB

4. **Botocrates needs to perform a new move in order to ensure a better conclusion of the process of the *challenge to explain* floor.**

The overall framework of a particular exchange structure should contribute to achieving the goal of the expansion (Jackson and Jacobs, 1992, Cutting, 2005). At the end of the constructive expansion of the *challenge to explain* floor it would be effective if Botocrates could enable users to gauge the strength of their positions and their support in the light of Botocrates' responses (Kuhn and Udell, 2007, Andrews, 2010). The new proposed move consists of a summary of the line of reasoning and, in case of the complex *challenge to explain* processes, it also includes acknowledgment of the other side of the argument associated with the topic under discussion. Similar to this move is the '*reflect*' move found in the Discount Scheme proposed by Pilkington (1999) see chapter 4, section *Discount scheme*. In the new design of Botocrates' dialogue strategies, I called this move a '*Close-C2E*' move (*Close-Challenge to Explain* move). The functions of this move are: a) to help users to reflect on their line of argument connected to a certain *challenge to explain* floor (Aveyard et al, 2011, Cottrell, 2011, Padget, 2012), and b) to close the current exchange structure of a *challenge to explain* floor if the user initiates a new and irrelevant one.

Acknowledgment

Some of the contents of Botocrates' responses that appear in this example or in other examples throughout this chapter are quoted from related books & articles. The sources of these responses used to build Botocrates' KB or AAB were completely acknowledged in chapter 4 section The Wizard of Oz & in the list of references.

Botocrates: *Would you like to ask me a question or should I select a topic of my area of interest?*
BAT: *Ask me please*
Botocrates:*Do you agree with Prensky's classification (2001) of Digital native and Digital immigrants?*
BAT:*What is your opinion?*
Botocrates:*I am interested to know your opinion! What do you think?*
BAT:*Ok can you provide a description of the classification please?*
Botocrates: *Prensky defines the younger generation as the digital natives as they are all "native speakers" of the digital language of computers, video games and the Internet". Prensky refers to people who were born before this new digital era, which began around 1980, as Digital Immigrants.*
BAT: *I agree with that*
Botocrates:*Why do you think that?*
BAT: *I can see myself into the digital natives because we were born into the technologic era*
Botocrates: *Could you explain more?*
BAT: *Before the 80s people do not have a great impact of the technology in their lifes. After 80s, when technology began to have a great impact in our everyday life, children who were born after this period became digital natives they born and raised using technologic tools a computer, a television, a video-game etc*
Botocrates: *Yes but the classification is binary as It ignores the grey areas, it is based on whether we are digital immigrants or digital natives. The classification did not consider the gradual evolution of technology.*
BAT: *I think there is a middle class, people who were born after 80s but they still not have good relation with technology this is the main lack of the theory in my opinion.*
Botocrates: *It could be said that digital immigrants had to learn and adapt to using emerging technologies rather than seeing them as natural tools as part of their given world. People who grow up with technology are more likely to be comfortable with it than if they do not. However, the classification is binary as It ignores the grey areas, it is based on whether we are digital immigrants or digital natives. In some cultures teachers and students are equally familiar or unfamiliar with technologies. Would you like to ask me a question or should I select a topic of my area of interest?*

Example 50: Close-C2E' move and the Ask-explain move in action

Note that this example is extracted from one of the main evaluation sessions which shows the '*Close-C2E*' move and the *Ask-explain* move in practice.

As we can see in the example above, Botocrates invited the users to start a new topic and BAT accepted Botocrates' invitation to be engaged in the *challenge to explain* process. After the user stated his willingness, Botocrates probed BAT's opinion about Prensky's classification of Digital natives and Digital immigrants. As we can see, BAT did not state his opinion at the beginning and attempted to elicit Botocrates' opinion about the topic under discussion. For dealing with this response, Botocrates performed two conversational moves within the same turn. Botocrates responded to the user and directed the question "*I am interested to know your* *opinion! What do you think?*" back to the user. It appears that the lack of knowledge about the topic prevented BAT from stating his position about Prensky's classification but he did state his opinion after Botocrates provided him with some information about the classification. However, BAT stated his position without any support, which led Botocrates to re-initiate and perform a *Why-Question* move to encourage him to state the causal proposition for his opinion. As we can see, asking the question "*could you explain more*?" helped BAT to develop his line of reasoning by giving further explanation. After the user stated his position and line of reasoning, Botocrates successfully implemented the next step of the *complex challenge to explain* process by making a counter move (*yes but*) followed by some of the justifications of the other side of argument (counter-argument). In response to the *Counter* move made by Botocrates, BAT acknowledged and agreed with some of the hidden issues such as the limitation of having a binary classification. In the final contribution made by Botocrates, related to this floor, '*Close-C2E*' move (*Close-Challenge to Explain* move) aimed at helping BAT to reflect on their line of argument and to mark the end of the current *challenge to explain* process.

7.3 Main Evaluation

The total number of participants who took part in this stage of evaluation was 5. The participants were requested to chat with Botocrates and they were interviewed straightaway after the chat sessions.

As we can see in *Table 46* & *Figure 45*, the accuracy of the wizard's execution of the designed dialogue strategies during the main evaluation experiments accounted for 96% (total correct moves=187) compared with wrong moves which represented 4% (total wrong moves=6).

NO	Session	The accuracy of the wizard's moves				Total moves
		Correct Moves		Wrong moves		
1	ALE	51	96.3%	2	3.7%	53
2	KAY	42	95.5%	2	4.5%	44
3	PAR	24	96%	1	4%	25
4	BAT	45	97.8%	1	2.2%	46
5	SES	25	100%	0	0%	25
Total		187	96%	6	4%	193

Table 46: The accuracy of the wizard's moves during the main evaluation

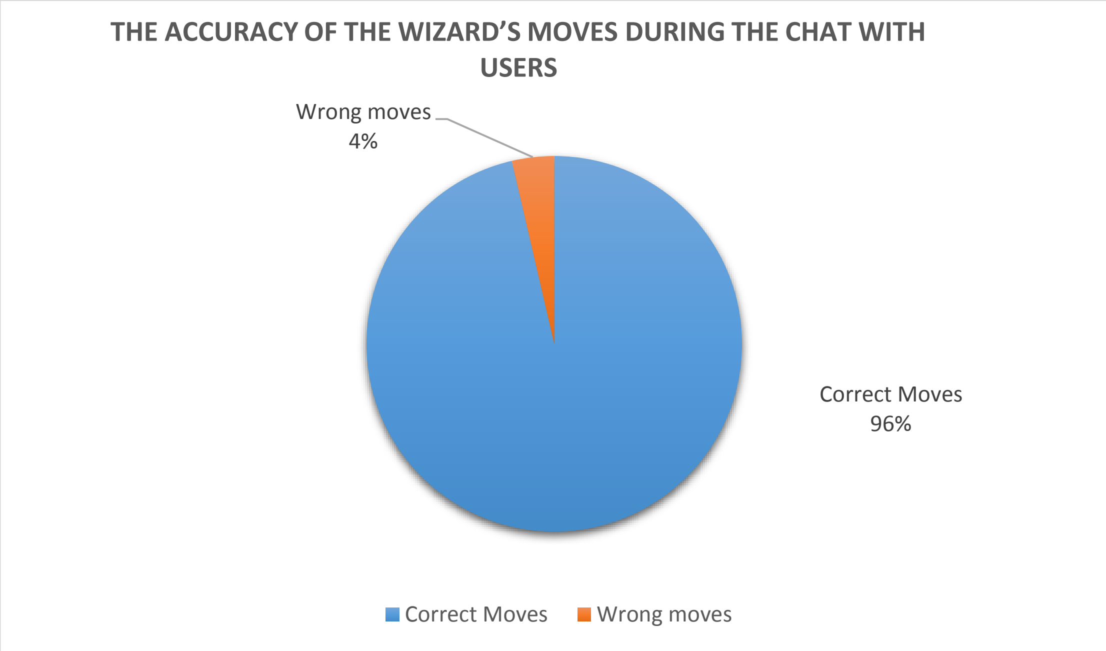


Figure 45: The accuracy of the wizard's moves during the main evaluation

The high level of correct implementation of Botocrates' dialogue strategies is attributed to the extensive training sessions (11 sessions) given to the wizard before the execution of the main evaluation experiments. *Figure 46* below shows the gradual improvement in the rate of the wizard's correct moves during the training sessions.

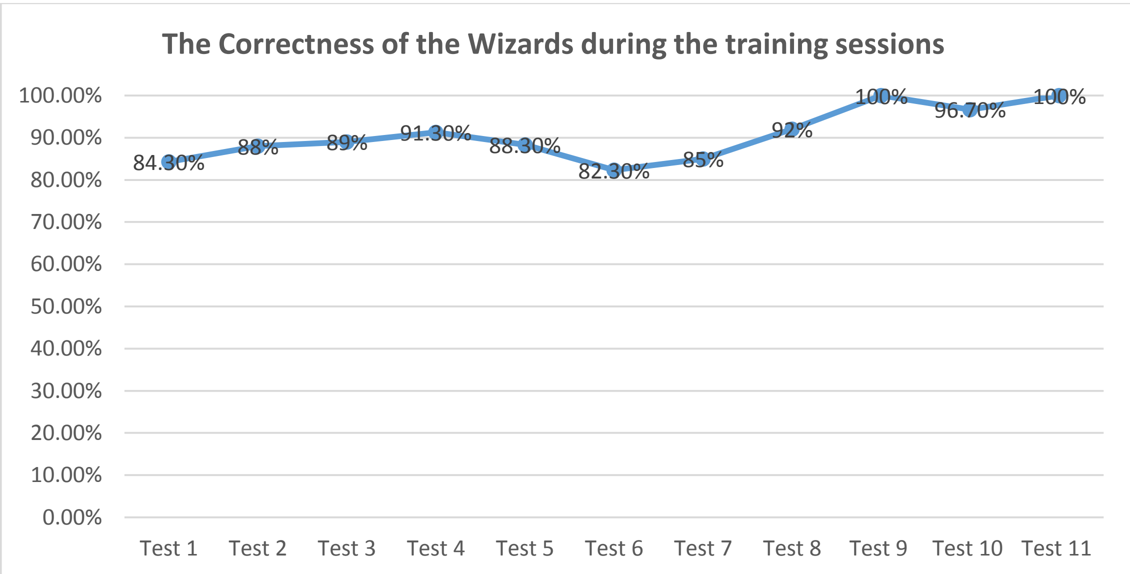


Figure 46: The rate of correctness of the Wizard during the training sessions

For further details about the procedures that had been done during this stage of the research study, see chapter 4, section *Phase two: The evaluation of Botocrates' prototype*.

Analysis of the Results

Exchange Structure Analysis ESA

The rationale for applying ESA is to investigate the mechanisms regulating the flow of the chat between Botocrates and users (Kneser et al, 2001). ESA could give us an insight into the extent to which Botocrates and users were adopting active roles during the dialogue (Pilkington, 1999). While the active role in a dialogue is recognized by the number of Initiating (I), Reinitiating (RI), and some of the Response-complement (RC) moves such as feedback moves, the passive role is identified by the numbers of Responding (R) and some of the Response-complement (RC) moves such as acknowledgment moves (Pilkington, 1999, Kneser et al, 2001). In addition, examining the patterns of the exchange structures during the chats can provide an initial indication as to whether users and Botocrates were engaging in the *challenge to explain* processes or not (Pilkington, 1999, Kneser et al, 2001, Pilkington, 2001, Pilkington and Walker, 2003b). For more details about the ESA analysis see chapter 4 the methodology, section *Discount scheme*.

The results from the analysis of the 5 logs of the chats suggest that Botocrates successfully adopted the active role during the chats. As we can see in *Table 47* the analysis of Botocrates' ESA showed a high level of active locus of control in the dialogues - 86% of turns compared to only 14% reserved for performing passive turns.

NO	Session	NO of Botocrates' turns	Botocrates ESA				Locus of Control in Dialogue		Initiative swap
			I	R	RC	RI	Passive	Active	
1	ALE	34	17	10	13	13	14.7%	85.3%	12
2	KAY	29	16	15	5	8	20.6%	79.4%	12
3	PAR	14	10	8	4	3	14.3%	85.7%	7
4	BAT	28	17	16	6	7	14.2%	85.8%	15
5	SES	12	12	13	0	0	8.3%	91.7%	11
	Total	117	72	62	28	31	14%	86%	57

Table 47: Botocrates' Exchange structure categories during the chat with users

The key elements that allow Botocrates to play the active role are the initiative swap tactics. The initiative swap roles took place when Botocrates switched from Responding (R) moves to Reinitiate (RI) or Initiate (I) moves within the same turn. As we can see in *Table 47* & *Table 48*, Botocrates made the highest number of role swapping moves during the five sessions. By examining the total number of the initiative swap moves (72) made during the five sessions, we can notice that the total number of Botocrates' initiative swap moves was (57) which accounted for 79% of the total numbers of initiative swap moves compared with (15) Initiative swap moves that represented only 21% made by the 5 users.

NO	Users	NO of users' turns	Users' ESA				Locus of Control in Dialogue		Initiative swap
			I	R	RC	RI	Passive	Active	
1	ALE	34	5	31	6	8	40%	60%	5
2	KAY	29	9	15	3	6	44.8%	55.2%	2
3	PAR	14	7	10	1	2	42.9%	57.1%	4
4	BAT	28	8	21	3	6	46.5%	53.5%	3
5	SES	12	11	1	0	1	0%	100%	1
	Total	117	39	78	13	23	35%	65%	15

Table 48: Users' Exchange structure categories during the chat with Botocrates

Examples of the Initiative swap tactics:

(51.1)

KAY: *Hello*

Botocrates: *Hello there! I am Botocrates.I was born in the School of Education at the University of Leeds. I am here to answer any questions related to the Module EDUC5256M. Would you like to ask me a question or should I select a topic of my area of interest?*

(51.2)

Botocrates: *Do you agree with Prensky's classification (2001) of Digital natives and Digital immigrants?*

BAT*: what is your opinion?*

Botocrates: *I am interested to know your opinion! What do you think?*

Example 51: Initiative swap tactics

Another indication of the active role is the number of Initiate (I) and Reinitiate (RI) turns compared to Respond turns (R) (Pilkington, 1999, Kneser et al, 2001). As *Figure 47* & *Figure 48* illustrate, the Initiate turns (I) & Reinitiate turns (RI) of Botocrates showed the highest proportion with 37 % and 32% respectively compared to the other patterns of exchange structure. On the other side the users' Respond turns (R) dominated their patterns of exchange structure with 51% of their overall ESA.

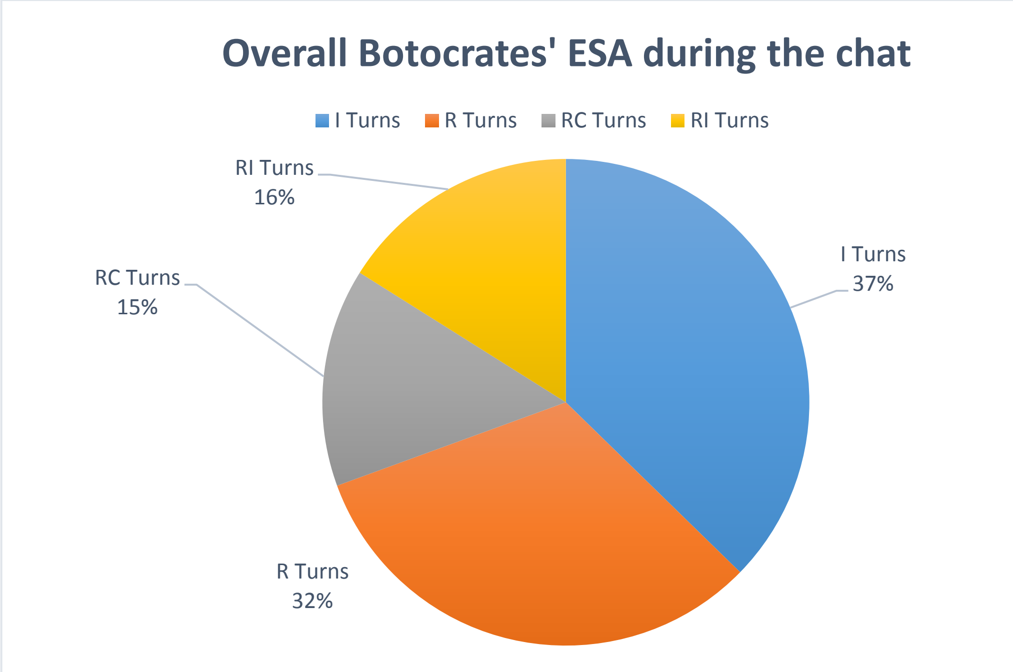


Figure 47: Overall Botocrates' ESA during the chats

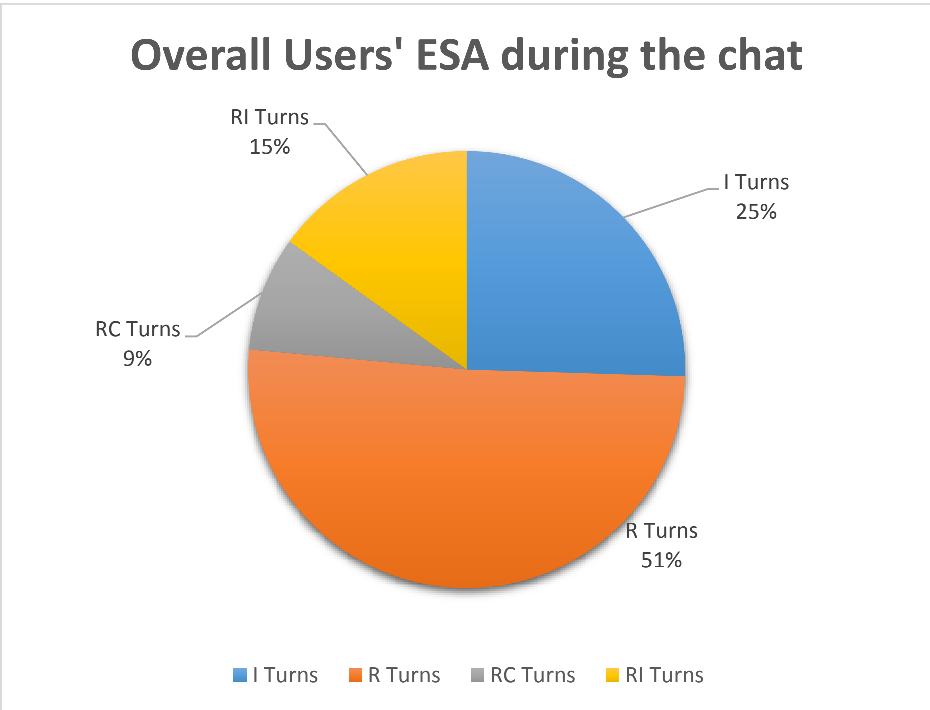


Figure 48: Overall users' ESA during the chats

As we can see in *Table 48*, the analysis of users' exchange structure patterns showed a notable rate of active participation as the overall average of their level of active locus of control represented 65% compared to 35% for the passive turns. I would say that the advantage of using the *Ex-St-Opener* move (*Would you like to ask me a question or should I select a topic* *of my area of interest?*), which aims to invite users to start a new exchange structure, is not only to help in controlling the dialogue flow, but also it enables users to take the initiative back from Botocrates. Even though it might be said that users can initiate new exchange structures at any time of the dialogue, this move would help in '*naturalising*' the flow of the chat. Such a move could facilitate what I called a '*shared control*' state. A '*shared control*' state occurs when the agent who holds the current floor offers the initiative roles to users. Savino and Refice (2003) state that "one of the main challenges in the development of dialogue systems is the attempt to 'naturalise' interaction as much as possible" (p.421).

As a result of an *Ex-St-Opener* move during the chats, users were able to 'naturally' take the active roles by initiating new exchange structures of information-seeking floors or other types of user-initiation floors. In addition, social conventions floors initiated by users at the beginning and at the end of the chats contributed to raising users' levels of active participation (see section *Conversational floor analysis* later in this chatper).

By comparing the numbers of users' Initiate (I) and Respond (R) moves, the findings suggest that users had different communicative behaviours when chatting with Botocrates. As presented in *Table 49*, *Table 50*, *Table 51* & *Table 52* ALE, BAT, KAY & PAR showed an overall tendency to Respond (R) rather than Initiate (I), whilst SES had a massive preference for Initiate (I) moves over Respond (R) ones.

Interlocutor	NO of turns	I	R	RC	RI	Initiative swap
Botocrates	34	17=31%	10=19%	13=25%	13=25%	12
ALE	34	5=10%	31=62%	6=12%	8=16%	5

Table 49: ALE and Botocrates' Exchange Structure Analysis ESA

Interlocutor	NO of turns	I	R	RC	RI	Initiative swap
Botocrates	28	17=37%	16=35%	6=13%	7=15%	15
BAT	28	8=21%	21=55%	3=8%	6=16%	3

Table 50: BAT and Botocrates' Exchange Structure Analysis ESA

Interlocutor	NO of turns	I	R	RC	RI	Initiative swap
Botocrates	29	16=36%	15=34%	5=11%	8=19%	12
KAY	29	9=27%	15=46%	3=9%	6=18%	2

Table 51: KAY and Botocrates' Exchange Structure Analysis ESA

Interlocutor	NO of turns	I	R	RC	RI	Initiative swap
Botocrates	14	10=40%	8=32%	4=16%	3=12%	7
PAR	14	7=35%	10=50%	1=5%	2=10%	4

Table 52: PAR and Botocrates' Exchange Structure Analysis ESA

Interlocutor	NO of turns	I	R	RC	RI	Initiative swap
Botocrates	12	12=48%	13=52%	0=0%	0=0%	11
SES	12	11=84%	1=8%	0=0%	1=8%	1

Table 53: SES and Botocrates' Exchange Structure Analysis ESA

In terms of users' engagement in argumentation, as shown in *Table 49*, *Table 50*, *Table 51* & *Table 52*, the numbers of Reinitiate (RI) and Response-complement (RC) moves of Botocrates and users (ALE, BAT, KAY & PAR) could be an indication of their engagement in the *challenge to explain* or *opinion-exchange* floors. While Reinitiate (RI) categories might carry *Ask-clarify ('what do you mean?'), Why-Question ('why do you think that', Ask-Explain ('could you explain more'), Counter ('yes but'.....)* moves, Response-complement (RC) categories could represent *feedback* or *Close-C2E* moves. As we can see in *Table 49*, for example, the number of Reinitiate (RI) and Response-complement (RC) moves of Botocrates in ALE's session accounted for 25% (total 13) and 25% (total 13) respectively and on the other side 12 % (total 6) Reinitiate (RI) and 16% (total 8) Response-complement (RC) moves made by ALE.

As we will notice in the next section *Conversational move analysis*, the results of the conversational moves analysis suggest that on the one hand Reinitiate (RI) categories of Botocrates were reserved for moves needed for implementing the process of the *challenge to explain* floor such as *Ask-clarify*, *Why-Question*, *Ask-Explain*, *Counter* moves. And on the other hand the Reinitiate (RI) categories performed by users were mostly intended to ask for clarification questions related to the terms that were mentioned by Botocrates. It could be said that Botocrates was adopting the role of 'critic' and some of the users tended to play the role of 'clarifier' most of the time. As suggested by Kneser et al (2001) the 'critic' role in the argumentation process can be recognized by challenging moves and the 'clarifier' role in the argumentation process tends to ask clarification questions more often. The role of 'critic' adopted by Botocrates can positively encourage the users to be engaged in reflective thinking processes (Killen, 2006). For example:

Botocrates: *What do you think of applying Salmon's model (2002) of online teaching and learning in a Blended Learning environment?*

PAR: *I am not familiar with Salmon's model. Could you give me a brief overview?*

Example 52: User's RI move (the clarifier role)

Botocrates: *Do you agree with Prensky's classification (2001) of Digital natives and Digital immigrants?*

ALE: *Good one. No I dont.*

Botocrates: *Why do you think that?*

Example 53: Botocrates' RI move (the critic role)

However, the high level of active participations does not always indicate the users' engagement in the argumentation process. For example, SES who made 100% of active turns was mainly initiating new exchange structures. As shown in *Table 53*, Botocrates in SES's session could not adopt the critic role (RI=0) as a result of SES's conversational behaviours during the chat. Such a chat where Botocrates acts as a responder (R=52% of his total moves) and the user (for instance, SES) acts mainly as an inquirer (I=84% of her total moves) could indicate an asymmetrical knowledge-building dialogue (Pilkington, 1999). An asymmetrical knowledge building dialogue can achieve limited development (Vass and Littleton, 2010), but the ultimate goal of Botocrates is to enable students to be immersed in the processes of the *challenge to explain* and a constructive critiquing dialogue (Moore, 2011). Understanding interlocutors' communicative behaviours could be achieved by means of the analysis of their conversational moves (Connolly, 1997, Enfield, 2009, Coulthard, 2013). The next section aims to explore users' communicative behaviours in depth.

Conversational moves

The aim of this section is to examine Botocrates' and users' interactional intentions during the chats. The interlocutors' communicative intentions can be inferred by the analysis of their performed conversational moves (Flor and Juan, 2010, Holtgraves, 2013, Yule, 2014, Kissine, 2013). Tracking Botocrates' communicative moves in turn explains whether Botocrates accomplishes the set of his tasks and sub-tasks or not (Pilkington, 1999, Walton, 2003, Psaltis and Zapiti, 2014). The success of Botocrates in achieving his main goal of interaction (promoting users' critical thinking and academic argumentation skills) depends on producing a relevant set of conversational moves such as *probe-opinion, ask-clarify, why-question, ask explain, counter* moves. In addition, the analysis of users' conversation moves illustrates the impacts of their communicative behaviours on the dialogue flow (Taylor and Bouwhuis, 2000, Andre and Pelachaud, 2010).

As shown in *Table 56*, all users (ALE, KAY, PAR, BAT, & SES) started the chat with *Greet* moves (total 5) and ended the chats with *Bye* moves (total 5). As *Table 54* illustrates, Botocrates successfully performed social conventions moves in response to users *Greet* and *Bye* moves. These social obligation management moves are necessary to be taken into account in order to achieve the phatic function which in turn contribute to raising successful interactions and overall users' positive impressions (Bunt, 2013a, Duplessis et al, 2013).

As we can see in *Table 54*, *Give-Info* moves performed by Botocrates during the chats with users constituted the second highest number of moves 20.2% (total 39 moves) of his total conversational moves (193 moves). *Give-info* moves were intended to pass information to users in response to *Request-info* moves and *ask-clarify* moves made by users. As shown in Table *Table 56* the total numbers of users' *Request-Info* moves (22) and *Ask clarify* moves (17) was 39. For example:

ALE: *Now what exactly do you mean by a Blended learning environment?*

Botocrates: *Blended learning Environments can be defined as a combination of both face to face/traditional learning and teaching instructions and online learning environment/e-learning instructions to achieve educational goals.*

Example 54: User's Ask-clarify move

KAY: *What is e-learning please?*

Botocrates: *Online learning or e-learning is defined as learning with the use of information technology devices. Online instruction is an innovative approach for delivering instruction to a remote audience, using the Web as the medium.*

Example 55: User's Request-info move

	Botocrates' main conversational moves	Sessions										Total moves	
		ALE		KAY		PAR		BAT		SES			
1	Greet	1	1.8%	2	4.5%	1	4%	1	2.1%	1	4%	6	3.1%
2	Introduce	1	1.8%	1	2.2%	1	4%	1	2.1%	1	4%	5	2.6%
3	Give-Info	4	7.5%	10	22.7%	5	20%	10	21.7%	10	40%	39	20.2%
4	Ex-St-Opener	10	18.8%	11	25%	7	28%	13	28.2%	11	44%	52	27%
5	Probe-Opinion	8	15%	5	11.3%	2	8%	6	13%	0	0%	21	10.8%
6	Ask-Clarify	0	0%	1	2.2%	0	0%	0	0%	0	0%	1	0.5%
7	Why-Question	4	7.5%	2	4.5%	2	8%	1	2.1%	0	0%	9	4.7%
8	Ask-Explain	1	1.8%	1	2.2%	0	0%	1	2.1%	0	0%	3	1.6%
9	Counter	2	3.7%	3	6.8%	1	4%	2	4.3%	0	0%	8	4.1%
10	Hint	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
11	Fallacy-Detection	2	3.7%	0	0%	0	0%	0	0%	0	0%	2	1.2%
12	Direct	3	5.6%	1	2.2%	0	0%	3	6.5%	0	0%	7	3.6%
13	Feedback	7	13.2%	0	0%	2	8%	1	2.1%	0	0%	10	5.1%
14	Close-C2E	6	11.3%	4	9%	2	8%	3	6.5%	0	0%	15	7.8%
15	Backchannel	0	0%	1	2.2%	0	0%	2	4.3%	0	0%	3	1.6%
16	Request-Reformulate	1	1.8%	0	0%	0	0%	0	0%	0	0%	1	0.5%
17	Closing-Statement	1	1.8%	1	2.2%	1	4%	1	2.1%	1	4%	5	2.6%
18	Bye	1	1.8%	1	2.2%	1	4%	1	2.1%	1	4%	5	2.6%

Table 54: Botocrates' Main moves during the chat with users

The analysis of *Give-info* moves was further examined to find out whether these moves were successful or unsuccessful. While successful *Give-info* moves showed the ability of Botocrates in passing the required information, unsuccessful *Give-info* moves indicated the deficiency of Botocrates in terms of the lack of enough data stored in the knowledge base. As *Table 55* illustrates, the successful *Give-Info* moves executed by Botocrates represented 79% (total 31 moves) compared to unsuccessful ones that accounted for 21% (total 8). The findings suggest that the successful accomplishment of Botocrates' main task related to information-seeking floors relies on the extensive efforts that must be made to build a thorough knowledge base.

NO	Session	Total number of Give-Info	Successful Give-info		Answer-Not-Found	
1	ALE	4	4	100%	0	0%
2	KAY	10	8	80%	2	20%
3	PAR	5	3	60%	2	40%
4	BAT	10	9	90%	1	10%
5	SES	10	7	70%	3	30%
	Total	39	31	79%	8	21%

Table 55: Successful and unsuccessful Give-Info moves

In addition, examination of the nature of the users' *Request-info* moves suggests that users sometimes tend to ask for suggestions and recommendations that were not considered by Botocrates when building the knowledge base (KB). Such questions need to be taken into account for creating the KB that could satisfy users' goals of interactions. For example:

(56.1)

KAY: *Can you recommend good apps or websites for developing writing skills?*

(56.2)

BAT: *Do you know any digital activities for students in primary schools?*

(56.3)

SES: *Can you suggest me literature for further reading in this topic?*

Example 56: Recommendations and suggestions requested by users

NO	User's main conversational moves	Users										Total moves	
		ALE		KAY		PAR		BAT		SES			
1	Greet	1	2%	1	3%	1	5%	1	2.6%	1	8%	5	3.2%
2	Request-Info	0	0%	4	12.1%	4	20%	5	13.1%	9	68%	22	14.2%
3	Accept-Offer	5	10%	4	12.1%	2	10%	3	7.9%	0	0%	14	9%
4	Direct	3	6%	0	0%	0	0%	1	2.6%	0	0%	4	2.6%
5	Probe-Opinion	2	4%	1	3%	0	0%	3	7.9%	0	0%	6	3.9%
6	Inform-Opinion	8	16%	4	12.1%	4	20%	5	13.1%	0	0%	21	13.6%
7	Ask-Clarify	4	8%	6	18.1%	1	5%	5	13.1%	1	8%	17	11%
8	Request-Confirm	2	4%	0	0%	0	0%	0	0%	0	0%	2	1.3%
9	Give-Reason	8	16%	4	12.1%	2	10%	4	10.5%	0	0%	18	11.7%
10	Fallacy	2	4%	0	0%	0	0%	0	0%	0	0%	2	1.3%
11	Acknowledge-Counter	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
12	Defend-attack	1	2%	0	0%	1	5%	0	0%	0	0%	2	1.3%
13	Closing-Statement	0	0%	0	0%	1	5%	0	0%	0	0%	1	0.7%
14	Bye	1	2%	1	3%	1	5%	1	2.6%	1	8%	5	3.2%
15	Disagree	0	0%	0	0%	1	5%	0	0%	0	0%	1	0.7%
16	Agree	0	0%	1	3%	0	0%	4	10.5%	0	0%	5	3.2%
17	Thank	1	2%	3	9%	1	5%	3	7.9%	1	8%	9	5.8%
18	Apology	2	4%	0	0%	0	0%	0	0%	0	0%	2	1.3%
19	Feedback	5	10%	2	6%	1	5%	3	7.9%	0	0%	11	7.1%
20	Backchannel	1	2%	1	3%	0	0%	0	0%	0	0%	2	1.3%
21	Abounded	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
22	Unrecognized	1	2%	0	3%	0	0%	0	0%	0	0%	1	0.6%

Table 56: Users' Main moves during the chat with Botocrates

As noticed in *Table 56* the overall number of users' *Request-info* moves (14.2%= 22 moves) represented the highest number of their moves made when conversing with Botocrates. By looking at the total numbers of *Request-Info* moves made by each user (ALE, KAY, PAR, BAT & SES), we can see that there is a notable dissimilarity between users' interactional intentions.

For example, while ALE did not make any *Request-info* move, SES's *Request-Info* moves constituted 68% (total 9 moves) of her entire conversational moves (total 13 moves).

Here I would like to go back to the notion of a *'shared control'* state that I introduced earlier in this chapter. As we can notice in *Table 54* the *'shared control'* state seen in Botocrates' *Ex-St-Opener* moves accounted for 27% (total 52 moves). It could be claimed that, users' domination of the *'shared control'* state is driven by two influencing factors: a) users' goal of interaction, and b) users' feelings towards Botocrates. The goal of users when conversing with Botocrates leads them to adopt certain conversational behaviours which control the generation and the performance of related dialogue strategies. To support my claim, let us, for example, explore some of the users' conversational behaviours in depth.

1) SES who made only 13 moves was dominating the '*shared control*' state by merely requesting information (*Request-Info* moves=9, see *Table 56*). During the interview SES stated:

"It is useful for searching information… but I prefer to discuss with real people. I understand it is similar with Siri and it can be useful for someone who has problem when interacting with other people"

As shown in *Table 56*, SES did not make any *probe-exchange* moves (*Probe-Opinion*=0 move) and did not accept any offers to establish the *challenge explain* floors (*Accept-Offer*=0 move). From the results of the analysis of SES's interview and logs, it could be said that, SES's prior attitudes and feelings towards the system might affect her communicative behaviours.

2) ALE did not make any *Request-info* moves, he accepted the offer of Botocrates 5 times (*Accept-offer*=5 moves), he asked Botocrates to select the topic of interaction 3 times (*Direct*=3 moves), and he initiated a *probe-exchange* floor 2 times (*Probe-opinion*=2 moves), see *Table 56*. ALE pointed out:

"*I felt quite natural chatting with the robot..... I think this tool is a great tool for preparation. So if you come for assessment and testing this could be very helpful especially when the chatbot chooses the questions, it a bit like you are testing the environment".*

3) BAT initiated 5 information-seeking floors (*Request-info*=5 moves), he accepted the offer of Botocrates 3 times (*Accept-offer*=3 moves), he asked Botocrates to select the topic of interaction one time (*Direct*=1 moves), and he initiated a *probe-opinion* floor 3 times (*Probe-opinion*=3 moves), see *Table 56*. BAT stated:

"*I like the way we were speaking. We had a nice discussion. Even I know this is a computer it is really interesting to see different perspectives in our module apart from face to face and online seminars and chatting with the tutor. It is something different and interesting for me".*

In both the ALE & BAT cases, the results suggest that users' impressions and their goals of interactions such as preparation and seeing things from different perspectives led them to adopt a more '*co-control*' dialogue behaviour. '*Co-control*' refers to the situation during the dialogue where users give the opportunity to the agent to lead the discussion. The section *Users' feelings* in this chapter explores users' perspectives in more detail.

In terms of the students' engagement in critical and reflective discussions, as shown in *Table 54* the number of *probe-opinion* moves made by Botocrates represented the third highest number of moves 10.8% (total 21 moves). As I explained in chapters 5 & 6, *probe-opinion* moves can be seen as the seeds of the argument trees which can be developed by the process of argumentation. *Table 56* shows that users made 21 *inform-opinion* moves which accounted for 13.6% of their total moves. ALE & KAY's feelings are worth mentioning here as they are connected to Botocrates' *probe-opinion* and users' *inform-opinion* moves. ALE during the interview stated:

"It asks you about your own opinion and this is something very different isn't it? Because you do not only need to give it what you know about, but also you need to give your own opinions and values. .... It does not ask for example can you say the five different steps… it does not ask for subject knowledge… you really have to forcefully think what the question actually is about and the topic area and then also you have to connect what you personally think".

KAY pointed out:

"His questions need concentration because it sometimes asked me about my opinion"

Such comments from the participants are very telling and could suggest that my decision to employ interviews rather than questionnaires was the right one.

It could be argued that, *probe opinion* moves successfully create productive dialogue circumstances where users' beliefs and values are put "into practice in making decisions" (Newton, 2012, p.46).

The examples below illustrate Botocrates' *Probe-opinion* moves and users' *Inform-opinion* moves in action:

(57.1)

Botocrates: *Do you agree with Prensky's classification (2001) of Digital natives and Digital immigrants?*

PAR: *no!*

(57.2)

Botocrates: *Do you believe using synchronous text-based chat helps students develop the language they are learning?*

ALE: *Yes I do. The fact that students chat in a target language will help. Also, they are given time and space to express themselves (as opposed to a real conversation). This will help students who might need a bit more time to formulate sentences.*

(57.3)

Botocrates: *What do you think of applying Salmon's model (2002) of online teaching and learning in a Blended Learning environment?*

BAT: *Can you explain me in few words what is the Salmon's model?*

Botocrates: *According to Salmon (2002 and 2013), online learners progress through five stages: Access and motivation, On-line socialization, Information exchange, Knowledge construction and Development.*

BAT: *Ok thank you for the explanation. I think it is really useful model, especially for distance learning students that they do not have physical access to the course materials Like in our master's course the most of the students were distance learners.*

(57.4)

Botocrates: *Do you think using the Interloc tool for mediating discussions could promote students' academic argumentation skills?*

KAY: *i don't know about the interloc tool. What is it?*

Botocrates: *InterLoc is an educational learning tool that organises, mediates, structures and scaffolds educational dialogue games. The name comes from interlocutor. It allows students to play with, practice and develop their dialogue and cognitive skills in an engaging and motivating way.*

KAY: *yes i see that such a tool can help students develop argumentation skills.*

Example 57: Botocrates' probe-opinion moves and users' inform-opinion moves

In the case where Botocrates could not allocate the user's positions, Botocrates' *Ask-clarify* moves (*Ask-clarify* move=1) encouraged the user to clearly state the position. For example, Botocrates: *Do you agree with Prensky's classification (2001) of Digital natives and Digital immigrants?*

KAY: *there are some people cannot really use the technology even though they were born after its development.*

Botocrates: *What do you mean? Could you please elaborate?*

KAY: *Ok. I mean i dont agree with the classification!*

Botocrates: *Why do you think that?*

Example 58: Botocrates' Ask-clarify moves

As we can notice in examples (57.3) & (57.4), users tended to ask clarification questions if they were not able to take positions as a result of the lack of knowledge related to the raised issues. As presented in *Table 56* the overall numbers of users' *Ask-clarify* moves constituted 11% (17 moves). We can notice also in *Table 54* Botocrates did not make any *Hint* moves (*Hint*=0) which are designed to provide information related to the areas under discussion in case users state "*I do not know, I am not sure*" without performing *Request-info* or *Ask-clarify* moves. These findings could suggest that some users showed positive thinking dispositions and intellectual behaviours because of their desire to be well-informed (Ennis, 1985, Moore, 2011, Lai, 2011). Asking clarification questions performed by users to clarify what Botocrates meant is considered essential intellectual behaviour in the process of critical thinking (Thayer-Bacon, 2000). By exploring the *Ask-clarify* moves made by each user we can conclude that the tendency to adopt the 'clarifier' roles by asking clarification questions differs from one participant to the others. For example, KAY's *Ask-clarify* moves constituted the highest number 18.1% (total 6 moves) of his overall conversational moves. Also, BAT's Ask clarify moves represented the joint highest number 13.1% (total 5) of his overall conversational moves (see Table *56* & Table *57*).

NO	Users	Ask-Clarify moves	Average	Total moves
1	ALE	4	8%	50
2	KAY	6	18.1%	33
3	PAR	1	5%	20
4	BAT	5	13.1%	38
5	SES	1	8%	13

Table 57: Users' Ask Clarify moves during the chat

As *Table 58* shows ALE had the preference to play the role of evaluator when chatting with Botocrates.

NO	Users	Feedback moves	Average	Total moves
1	ALE	5	10%	50
2	KAY	2	6%	33
3	PAR	1	5%	20
4	BAT	3	7.9%	38
5	SES	0	0%	13

Table 58: Users' Feedback moves during the chat

For example:

(59.1)

Botocrates: *What do you think of applying Salmon's model (2002) of online teaching and learning in a Blended Learning environment?*

ALE: *Good question. What do you think?*

(59.2)

Botocrates: *Do you agree with Prensky's classification (2001) of Digital natives and Digital immigrants?*

ALE: *Good one. No I dont.*

Example 59: ALE's feedback moves

Turning to Botocrates' actions and the processes of the *challenge to explain* dialogue, *Table 54* illustrates the success of Botocrates in playing the role of 'critic' and producing the relevant set of moves such as *Why-question* (total 9) and *Counter* (total 8) moves. Another positive indication of the users' intellectual moves is that users' *Give-Reason* moves reported a higher number (total 18) compared to Botocrates' *Why-Question* moves (total 9). These results show the positive tendency of some users (ALE, KAY & BAT see *Table 59*) to state the support of their taken positions sometimes before Botocrates performs *Why-question* moves. On the contrary, PAR did hesitate and was unwilling to state her line of reasoning before Botocrates challenged her to do so. *Table 59* explains to what extent users were adopting the active explainer roles when chatting with Botocrates.

NO	Session	Botocrates' Why-question moves	User's Give-reason moves
1	ALE	4	8
2	KAY	2	4
3	PAR	2	2
4	BAT	1	4
5	SES	0	0

Table 59: Users' Give-reason moves compared to Botocrates' Why-question moves

In cases where users did not provide ‘sufficient’ support by not stating two or more of the sub-nodes of support, Botocrates’ *Ask-explain* (*Ask-explain*=3 moves) encouraged them to clarify their line of reasoning. For example:

KAY: *Yes I think sychronous text-based chat can help develop language learning.*

Botocrates: *Why do you think that?*

KAY: *because it provides opportunities for real-time response to questions.*

Botocrates: *Could you explain more?*

KAY: *if a student needs to ask for the correct way of pronouncing a word or words, it would be easy to do.*

Example 60: Botocrates’ Ask-explain moves

The findings also suggest that the users had obvious deficiencies in terms of acknowledging the other side of the argument and defending their position against the raised counter-argument. Not acknowledging the other side of the argument could be a consequence of not looking at the issues under discussion from multiple angles before users decide where they stand (LLC, 2010, Patnaik, 2015, Ruday, 2015). As we can notice in *Table 56*, users did not make any *Acknowledge-counter* moves (*Acknowledge-counter* =0 moves) and only in two instances did users successfully defend their positions (*Defend-attack*=2 moves). Also only one *Disagree* move was performed by all users (Disagree=1 moves). For example:

Botocrates: *Do you agree with Prensky’s classification (2001) of Digital natives and Digital immigrants?*

PAR: *no!*

Botocrates: *Why do you think that?*

PAR: *they're soundbites. The pace of technological change is too rapid for a core set of digital skills which could be viewed as essential and static. Secondly, very few people have a very deep knowledge of a wide range of software. Most people are not power users of anything. Age is not especially a determiner of this.*

Botocrates: *Yes but the new generation is more surrounded by technology than the previous generation. The cognitive style of digital immigrants and digital natives may differ regarding their thought processes.*

PAR: *no, I disagree. Think in evolutionary terms! The digital age is not even a nano second in the development of homo sapiens- this argument is unscientific.*

Example 61: PAR’s disagree and Defend-attack moves

Example 61 shows PAR who effectively defended her position. On the contrary, BAT agreed with the counter-argument raised by Botocrates:

Botocrates: *What do you think of applying Salmon's model (2002) of online teaching and learning in a Blended Learning environment?*

BAT: *Can you explain me in few words what is the Salmon's model?*

Botocrates: *According to Salmon (2002 and 2013), online learners progress through five stages: Access and motivation, On-line socialization, Information exchange, Knowledge construction and Development.*

BAT: *Ok thank you for the explanation. I think it is really useful model, especially for distance learning students that they do not have physical access to the course materials Like in our master's course the most of the students were distance learners.*

Botocrates: *Yes but the model is based on a distance learning environment and the complexities of working face to face and online have not been explored. There is a little guidance offered to apply the model. Different learners may be at different stages in this development process.*

BAT: *Of course, because every learner has an individual learning progress.*

Example 62: BAT's agree moves

Such situations where users did not acknowledge the counter-arguments connected to the topic under discussion could highlight the advantages of Botocrates' *close-C2E* moves which aim at enabling users to reflect on their line of argument at the end of each *challenge to explain* floor. Botocrates performed 15 *close-C2E* moves which accounted for 7.8% during the chats. Promoting users' thinking involves creating momentums that could lead users to re-evaluate and reconsider their initial judgment (Lipman, 2003). The integration and the acknowledgement of the other side of the argument in Botocrates' *close-C2E* moves might help users to realise fresh ideas of their own (Kaye, 1990, Swatridge, 2014).

In terms of *Fallacy-detection* moves which were executed by Botocrates twice during the five sessions (Botocrates' *Fallacy-detection* moves=2 & users' *Fallacy*=2 moves), see *Table 54* & *Table 56*, Botocrates encouraged users to clearly articulate their line of reasoning.

Let us look at the example below:

Botocrates: *Do you believe social presence is important for an online learning environment?*

ALE: *YES*

Botocrates: *Why do you think that?*

ALE: *we are humans ! not robots (Sorry Botocrates).*

Botocrates: *is that relevant? Could you explain more?*

ALE: *Because learning is very much an emotional endeavour. Humans arent necessarily rational, that notion that we are homo economicus is a myth. Our actions are based upon emotions…Look at* *all popular language learning apps.. Duolingo, Babbel...they are very popular at the start but then have extremely high drop out rates, as users can't be asked to keep going.*

Example 63: Botocrates' potential fallacy detection move (potential irrelevant premises)

As explained in chapter 6, section *Detect Fallacies,* this type of move is performed when Botocrates' cannot allocate the users' line of reasoning in the AAB which could indicate the fallacy of 'irrelevant premises'.

Another technical move made by Botocrates that helped in allocating and classifying users' utterances in Botocrates' brain is a *Request-formulate* move (*Request-formulate* moves=1). For example:

Botocrates: *Would you like to ask me a question or should I select a topic of my area of interest?*

ALE: *Fire away*

Botocrates: *Oops.What's happened? Something went wrong! Can you reformulate your sentence!*

ALE: *go ahead and ask another question*

Example 64: Botocrates' Request-formulate moves

As the results above show, Botocrates successfully implemented the set of moves relevant to social conventions, information-exchange, probe-exchange, and *challenge to explain* floors accordingly. It could be said that users' interactional intentions and communicative actions were central factors that contributed to shaping the dialogues. The next section explores the types of floor that resulted from turn-taking mechanisms which occurred during the five sessions.

Conversational floors

The aim of this section is to explore the whole structure of the dialogues between users and Botocrates. The investigation of the types of floor which took place during the interactions can be obtained by tracking the adjacency pair sequences (Sacks et al, 1974, Edelsky, 1981, Franck, 1985, Simpson, 2005a, Simpson, 2005b). Conversational floors in this section can be seen as the final products of the process of interactions between users and Botocrates (Shultz et al, 1982, Stotz, 1991). It is recognized at the higher level of the dialogue structure; higher than the level of turn and move (Hayashi, 1996). The conversational floor is seen as an essential element for topic cohesion during a conversation (Erickson, 1982, Simpson, 2005a). Hayashi (1996, p.31) defines the floor as "a cognitive entity that the interactants jointly create during the course of conversation". Here, I would like to define a conversational floor as the outcome of the set of turns that constitute and shape an exchange structure occurring during the interaction between Botocrates and a user.

As illustrated in chapter 6, section *6.5 Scenario and Dialogue Modelling*, the dialogue strategies of Botocrates were designed to deal with four main types of floors: a) social conventions floor, b) information-exchange floor, c) probe-exchange floor initiated by users, and d) *challenge to explain* floor. (For the justification of this design see chapter 6, section *6.5 Scenario and Dialogue Modelling*). The analysis of the conversational floors could enable us to see which types of conversational floor were dominating the whole structure of users' interactions with Botocrates.

- *Social conventions floor*

As we can notice in *Table 60* & *Figure 49* social conventions floors represented 21% (total floors=11) of the total number of floors during the five sessions. This type of floor typically does not require from Botocrates more than a single turn to close the exchange structure. The social conventions floors are not related to the main task of Botocrates, but the purpose of these floors is to take care of the social norms of interactions (Bunt, 2013a, Duplessis et al, 2013). For example:

(65.1)

BAT: *Hi*

Botocrates: *Hello there! I am Botocrates.I was born in the School of Education at the University of Leeds. I am here to answer any questions related to the Module EDUC5256M. Would you like to ask me a question or should I select a topic of my area of interest?*

(65.2)

PAR: *no thanks. I have to go now. Bye*

Botocrates: *It was nice to chat with you! Goodbye*

Example 65: A social convention floor

NO	Types of floor	Session										Total	
		ALE		KAY		PAR		BAT		SES			
Users-Initiation floor													
1	Social conventions floors	2	20%	3	25%	2	33.3%	2	15%	2	17%	11	21%
Information-exchange floor													
2	Information-seeking floors	0	0%	4	33%	2	33.3%	5	38%	10	83%	21	40%
3	Information-stating floors	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Opinion-exchange floors initiated by user													
4	Opinion-Seeking floors	2	20%	1	8%	0	0%	3	23%	0	0%	6	11%
5	Opinion-stating floors	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Botocrates-initiation floors (Challenge to explain floors)													
6	Challenge to explain floor	6	60%	4	33%	2	33.3%	3	23%	0	0%	15	28%
	Total number of floors	10		12		6		13		12		53	

Table 60: Types of conversational floors

- *Information-seeking floor*

The information-seeking floors constituted the highest numbers of floors - 40% overall (total floors=21). When examining the information-seeking floors initiated by each user we can notice remarkable differences between users' communicative intentions. For example, while ALE did not initiate any information-seeking floor (his information-seeking floor 0%=0 floors), SES's information-seeking floors dominated the whole structure of the interaction (information-seeking floors 83%=10 floors). As illustrated earlier the domination of the *'shared control'* state is motivated by two influencing factors: a) the users' goal of interaction, and b) the users' feelings towards Botocrates. These issues are discussed in more detail in the discussions section later in this chapter.

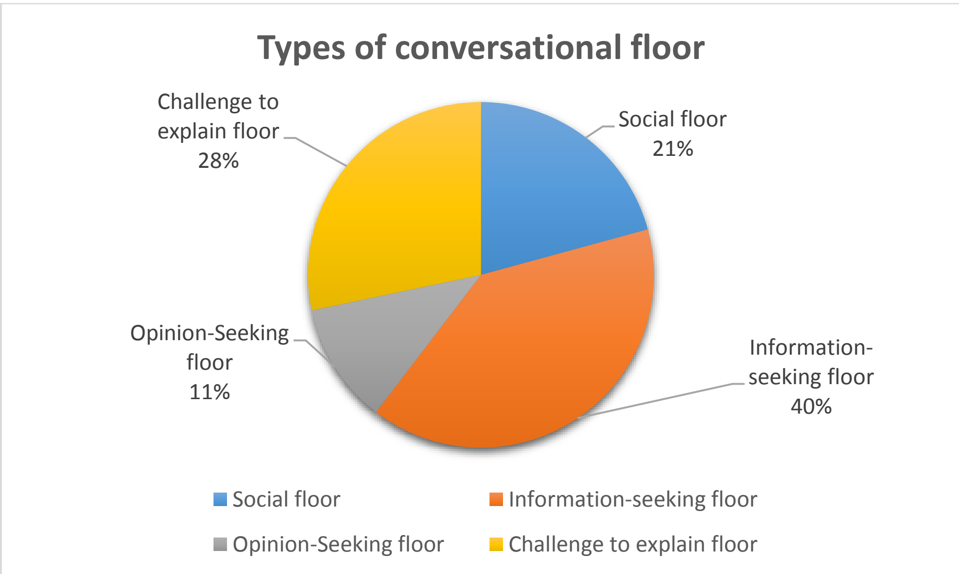


Figure 49: Types of conversational floor

The information-seeking floors are connected to one of the main tasks of Botocrates, providing information to users. For example:

BAT: *what is the socio-cultural theory?*

Botocrates: *Socio-cultural learning: Vygotsky's sociocultural theory of human learning describes learning as a social process and the origination of human intelligence in society or culture. Zone of proximal development" (ZPD) is the area of exploration for which the student is cognitively prepared, but requires help and social interaction to fully develop. Would you like to ask me a question or should I select another topic of my area of interest?*

Example 66: Answer was found in Botocrates' KB

The success of Botocrates in achieving the purpose of the users' interactions associated with this type of conversational floor was determined by the size of the Botocrates' knowledge base. For example:

SES: *What is Tutorial software?*

Botocrates: *Oops I have no answer, sorry my brain is under construction. I hope next time you will find the answer as the botmaster is continuously feeding my brain. Would you like to ask me a question or should I select a topic of my area of interest?*

Example 67: Answer was not found in Botocrates' KB

The analysis of data of the interviews revealed that most of the users' unsuccessful experiences when chatting with Botocrates happened during this type of floor. Users' satisfaction is mostly affected by the abilities of the agent to satisfy their goal of interactions (Abu Shawar and Atwell, 2007a, Quarteroni and Manandhar, 2007, Hastie, 2012). For example, BAT pointed out:

"I think that he needs more responses in order if I asked him questions he will have answers and I do not want him to say 'sorry I do not have an answer'. It was not nice to see that……….. When he cannot answer some questions he discourages the conversation"

In addition, it seems that even where Botocrates successfully allocated and passed the information to users, it did not necessarily ensure users' satisfaction with the provided responses. For example, during the interviews KAY confirms that:

"It needs secondary and alternative answers"

SES stated:

"For some questions he did not give answers … sometimes his answers were not clear".

Here I would suggest a small development to the dialogue tactics related to information-seeking floors. In response to the user's *Request-info* move, Botocrates needs to perform more than a single move in the same turn to close the current exchange structure. If the required information was found, the first move is to pass the information to users and the second move is to check users' satisfaction about Botocrates' responses. For example:

X: *What does a floor mean in a conversation?*

Botocrates: *The 'floor' in conversation is defined as "a sustained focus of cognitive, verbal, and nonverbal attention and response between speaker and audience". Are you satisfied with this answer?*

Example 68: The proposed modification to ensure users' satisfaction in users' Request-info moves

In the case where the user asks for further clarification or explanation, Botocrates performs another *Give-Info* move to retrieve information about the topic under discussion followed by the same move (a *check-satisfaction* move). In case Botocrates could not find further related information, he will respond using the canned response "*oops I have no answer, sorry my brain is under construction. I hope next time you will find the answer as the botmaster is continuously feeding my brain*" Followed by "*Would you like to ask me a question or should I select a topic of my area of interest?*" If the user responds to this clarification question by showing satisfaction, Botocrates then will invite the user to start a new exchange structure "*Would you like to ask me a question or should I select a topic of my area of interest?*"

- *Challenge to explain floor*

As shown in *Table 60* & *Figure 49* the *challenge to explain* floors represented the second highest floors - 28% overall (total floors=15). ALE's interactions with Botocrates reported the highest number of the *challenge to explain* floors - 60% (total 6 floors) of his total number of floors (total 10). This analysis of ALE's interview showed that the high number of his *challenge to explain floors* were driven by his communicative intention such as "*for preparation … testing the environment*" (quoted from ALE's interview). KAY, PAR & BAT also showed a notable tendency to accept being engaged in the *challenge to explain* processes as their *challenge to explain* floors constituted 33%, 33.3% & 23% respectively, see *Table 60*. The analysis of the three users' interviews (KAY, PAR & BAT) showed that the purpose of interaction is central to be engaged in such a floor. For example, KAY stated:

"It provided me with different opinions which are easier than reading and searching for articles especially when I do not have time"

PAR stated:

"I wanted to know Botocrates' area of interests"

BAT pointed out that:

"It is really interesting to see different perspectives in our module apart from face to face and online seminars and chatting with the tutor"

However, SES's conversational floors did not contain any *challenge to explain* floors (challenge to explain floor=0) as her ultimate goal of interaction is to get information about some topics. Here the challenge of Botocrates is how to lead such a user to be engaged in the *challenge to explain* processes. I would say that the key is the user's satisfaction related to her/his main goal of interaction. If Botocrates succeeds in achieving and satisfying the users' initial goal of interaction, this could increase the positive evaluation of the system (Cerrato and Ekeklint, 2006), which in turn might lead users to accept being engaged in the *challenge to explain* processes (Elragal and Birry, 2011).

The analysis of the *challenge to explain* floors revealed that Botocrates successfully executed the process of both types: simple and complex *challenge to explain* floors. While the complex *challenge to explain* floors constituted 73% (total complex *challenge to explain* floors=11) of the entire *challenge to explain* floors, the simple *challenge to explain* floors accounted for 27% (total simple *challenge to explain* floors=4, see *Figure 50*).

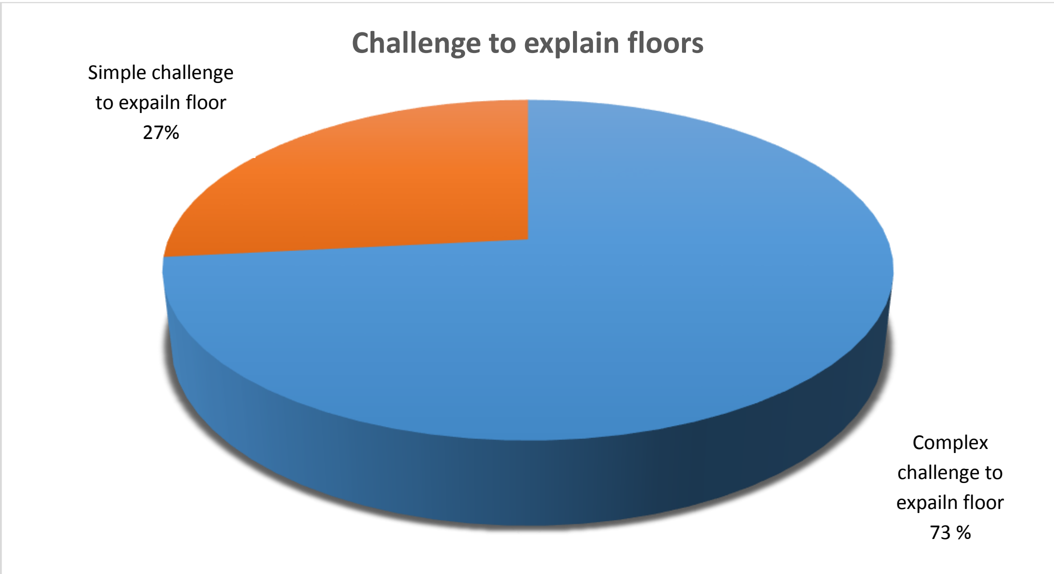


Figure 50: Challenge to explain floors

An example of the simple *challenge to explain* floor extracted from the main evaluation experiments:

Botocrates: *Do you agree that online learning is now an important aspect of higher education?*

ALE: *Absolutely.*

Botocrates: *Why do you think that?*

ALE: *It makes a lot of sense to provide online learning classes. They are cheap and accessible all over the world, technology is becoming more advanced, so it's easier for students to engage online*

Botocrates: *That sounds good. It could be said that online learning is now an important aspect of higher education because it offers convenience and flexibility by anytime and anywhere accessibility. It enables students to get immediate feedback. Better design of online learning includes multimodal learning elements that meet different learning styles. It offers a greater chance of interactions. It helps institutions to offer students a range of different programs and courses. Would you like to ask me a question or should I select a topic of my area of interest?*

Example 69: Simple challenge to explain floor

An example of the Complex *challenge to explain* floor:

Botocrates: *Do you agree with Prensky's classification (2001) of Digital natives and Digital immigrants?*

KAY: *there are some people cannot really use the technology even though they were born after its development.*

Botocrates: *What do you mean? Could you please elaborate?*

KAY: *Ok. I mean i dont agree with the classification!*

Botocrates: *Why do you think that?*

KAY: *I think some students do not have all the skills and knowledge required to be digital natives.*

Botocrates: *Yes but the new generation is more surrounded by technology then the previous generation. The cognitive style of digital immigrants and digital natives may differ regarding their thought processes.*

KAY: *That is true.*

Botocrates: *It could be said that digital immigrants had to learn and adapt to using emerging technologies rather than seeing them as natural tools as part of their given world. People who grow up with technology are more likely to be comfortable with it than if they do not. However, the classification is binary It ignores the grey areas, it is based on whether we are digital immigrants or digital natives. In some cultures teachers and students are equally familiar or unfamiliar with technologies. Would you like to ask me a question or should I select a topic of my area of interest?*

Example 70: Complex challenge to explain floor

In the processes of the *challenge to explain* floors where the users asked clarification questions, Botocrates was able to provide information that enabled users to take certain positions. However, not all Botocrates' *Give-info* moves were able to fulfil users' *Ask-clarify* moves. For example, during the interviews ALE stated:

"I think the issue is, if you ask for clarification and explanation, it gives you that, but if you did not understand that...I think that is as far as it goes."

Here the suggestion for further development is similar to the one illustrated in the Information-seeking floors. In response to users' *Ask-clarify* moves, Botocrates needs to perform two moves: a *Give-info* move followed by a *check-satisfaction* move. For example:

Botocrates: *What do you think of applying Salmon's model (2002) of online teaching and learning in a Blended Learning environment?*

BAT: *Can you explain me in few words what is the Salmon's model?*

Botocrates: *According to Salmon (2002 and 2013), online learners progress through five stages: Access and motivation, On-line socialization, Information exchange, Knowledge construction and Development. Are you satisfied with this answer?*

Example 71: The proposed modification to ensure users' satisfaction in users' Ask-clarify moves

In case the user requests further clarification or explanation, Botocrates then performs another a *Give-Info* move to retrieve information related to the topic being discussed followed by the same move (a *check-satisfaction* move). In case the user is not satisfied and Botocrates could not find any related information to offer, Botocrates will respond using the canned response "*oops I have no answer, sorry my brain is under construction. I hope next time you will find the answer as the botmaster is continuously feeding my brain*" Followed by "*Would you like to ask me a question or should I select a topic of my area of interest?*"

The final suggestion for further development of Botocrates' dialogue tactics is related to the *challenge to explain* floors is that the move '*Close-C2E*' (*Close-Challenge to Explain*) does not appear to mark the end of the *challenge to explain* floors every time. For example:

(72.1)

In reply to Botocrates' *Close-C2E* moves ALE replied as following:

ALE: *No let's stay with this topic for a bit. You say that technology is something new, which is not true. The telelphone was invented 140 years ago and people have been around that. The idea of digital native suggests that Web 2.0 is something entirely new, which it is really not (in my opinon).*

(72.2)

KAY replied as following:

KAY: *Yes, it ignores the grey area. That is what I mean.*

Example 72: Users' moves in response to Close-C2E moves

In the current design of Botocrates' dialogue strategies *Close-C2E* moves are followed by Ex-St-Opener "*Would you like to ask me a question or should I select a topic of my area of interest?*"

For naturalising the interactions, the current design needs to be modified to include a new move that checks users' readiness to close the current *challenge to explain* floor such as "*Is there anything else you would like to say*?" I called this move a '*check-readiness-to-C2E*' move. If the user responds by stating no or a similar meaning, then Botocrates will perform an *Ex-St-Opener* move "*Would you like to ask me a question or should I select a topic of my area of interest?*" In the case where the user states something, Botocrates will perform a *feedback* move and invite the user to start a new exchange structure.

- *Opinion-seeking floor initiated by users*

As shown in *Table 60*, the opinion-seeking floors represented 11% overall (total floors=6). This type of floor was designed to deal with any *probe-opinion* moves initiated by users. The motive behind asking such questions might be because the users have certain feelings (positive/negative or they might find these issues challenging in their professional careers) towards the topic under discussion (Bassot, 2015). For dealing with such a floor, Botocrates' tactics were created to encourage the users to state their opinions and to be engaged in reflective discussions (Newton, 2012). As shown in *Table 60* BAT's opinion-seeking floors constituted 23% (total floors=3) of his total floors produced during the interaction with Botocrates. ALE & KAY's opinion-seeking floors constituted 20% (total floors=3) and 8% (total floors=1) respectively, see *Table 60*. Both SES & PAR did not initiate any opinion-seeking floors.

The example below shows one of the *opinion-seeking* floors which occurred during BAT's session:

BAT: *ok, what do you think about the use of digital technology tools in primary education?*

Botocrates: *I am interested to know your opinion! What do you think?*

BAT: *That are useful and can help you to make a very creative lesson plan*

Botocrates: *That sounds good! Would you like to ask me a question or should I select a topic of my area of interest?*

Example 73: An Opinion-seeking floor

Other examples of *probe-opinion* moves initiated by users during the interactions with Botocrates are:

- *Do you think hiding real personality in online text has some side effect?*
- *Do you think online learning can fully replace face-to-face learning?*
- *Do you think that there is a lack in the constructivism theory?*

It could be said that this type of floor can be described as a treasure that could be a valuable source for building more areas of the *challenge to explain floors*. This issue will be explored in more detail in the discussion section.

Users' perspectives

As presented above, the analysis of the logs extracted from the WOZ experiment was carried out to examine the actual users' conversational behaviours when chatting with Botocrates. This section is intended to investigate users' perceptions and feelings regarding the process of interactions for evaluating Botocrates' interactional performance from users' perspectives. Exploring users' perpectives about the interaction with Botocrates is seen as a vital factor for evaluating conversational agents (Abu Shawar and Atwell, 2007b, Quarteroni and Manandhar, 2007, Hastie, 2012). The qualitative analysis of the interviews was conducted to contribute to answering the following question: 'How do students feel when chatting with Botocrates?' The thematic analysis of the data of the interviews generated 6 themes related to the objectives of this stage of the research study: users' rates of satisfaction, users' unsuccessful experiences, users' successful experiences, challenges facing users when interacting with Botocrates, users' motivations to chat with Botocrates again and their purposes of interaction.

Users' rates of satisfaction

Asking the users to rate their levels of satisfaction aims to explore the overall level of personal impression, pleasantness and experienced comfort when the users conversed with Botocrates (Moller, 2006). The results obtained from analysis of the interviews reported notable differences between users' rates of satisfactions. ALE and KAY showed a relatively high level of satisfaction as they rated their satisfaction with Botocrates interaction as 8 out of 10. BAT rated his satisfaction as 7 out of 10. The lowest levels of satisfactions were reported by SES and PAR who rated their satisfaction with Botocrates as 6.5 and 5 out of 10 respectively. ALE, KAT, and BAT were more positively expressive about their satisfaction as they described the interactions with Botocrates as interesting, useful and a new experience.

For example, ALE stated:

"I was quite interested in how it works….. I felt quite natural chatting with the robot…. So overall it was interesting experience."

KAY pointed out that:

"*Because I have never chatted with such software, I felt that it was a new and useful experience*"

BAT stated:

"*It was really interesting experience. I like the way we were speaking. We had a nice discussion*"

SES found the idea of Botocrates is an interesting one as she said:

"It was quite interesting approach"

It could be said that users' satisfaction is considered a subjective metric since their individual differences and needs may play important roles in shaping their attitudes towards Botocrates (Cerrato and Ekeklint, 2006). Meeting users' expectations and achieving their goals of interactions seem to be two central elements contributing to increasing or decreasing the level of users' satisfaction (Jokinen and Mctear, 2010). Examining users' successful and unsuccessful experiences could give us a better understanding of the factors influencing users' rates of satisfactions. Such diverse experiences constitute the overall users' degree of satisfaction (Andrews and Quarteroni, 2011, Mencia et al, 2011).

- *Users' unsuccessful and successful experiences*

The negative experiences reported by the five users (ALE, KAY, PAR, BAT & SES) were mostly due to the shortcomings of Botocrates' KB. Not passing the requested information and not providing sufficient clarifications to the users were the main causes of their dissatisfactions when chatting with Botocrates. As reported by BAT, not answering users' questions can discourage the discussion. The low level of satisfaction stated by both PAR and SES is attributed to the failure of Botocrates in terms of enabling them to achieve their goal of interactions. As shown earlier in *Table 55*, section *conversational moves*, the highest instances of Botocrates' failure in supplying the wanted information occurred during PAR's and SES's sessions. During PAR's and SES's sessions, 40% and 30% of Botocrates' *Give-info* moves respectively were unsuccessful moves. These findings are compatible with the results reported by similar previous studies which investigated the use of a conversational agent for information retrieval (Walker et al, 2001, Quarteroni and Manandhar, 2007).

SES stated:

"If you want to go deeper and you already know something in this field and you want to make it broader I think it quite hard for him because he sometimes did not gave proper answers"

PAR stated:

"He could not provide in-depth information….I felt disappointed because of the limited topics of the chat…. When using this tool I need to find answers to my questions"

It appears that PAR also was not satisfied with Botocrates' request in terms of asking users to discuss only about the two units (two & three). As illustrated in chapter 4, section *Procedures of recording and collecting wizard of Oz data*, the participants were invited to chat with Botocrates only about the two units (two & three) of the module EDUC5256M, Technology Enhanced Language Learning. The main reason behind limiting the topics of the chats was to be able to reasonably build the KB (within the timeline of the research) that can satisfy the user's *Request-Info* moves.

ALE and PAR also pointed out that the delay in responding to the users was among the negative experiences during the interactions. *"He takes a bit of time to respond"* (ALE), *"he took a bit of time to display the response"* (PAR). Such findings are due to the nature of the WOZ experiments since the wizard needed a bit of time to find the answer and construct the response to the users.

Regarding the *challenge to explain* processes, PAR described some of Botocrates' responses as '*formulaic*' and '*annoying*'.

"As I expected some of the responses were formulaic, he throws questions back e.g why do you think that? is a bit annoying but forces a response."

Despite the fact that one of the goals of Botocrates is to satisfy users, Botocrates has his own tasks and goal that should be achieved, which are connected to fulfilling the pedagogical purposes. Completing the task and the sub-tasks of Botocrates related to students' engagement in the *challenge to explain* processes is the ultimate goal of Botocrates. An evaluation process must be employed to Botocrates and to the users' needs. Assessing tasks' completion is the best technique for evaluating a conversational agent (Abu Shawar and Atwell, 2007b). Achieving the pedagogical purpose should be the central goal of Botocrates (Gulz et al, 2011).

In terms of users' positive experiences, apart from one event where Botocrates' could not recognize ALE's response when he said '*fire away*' (ALE), the five users confirmed that Botocrates understood their questions and responses as they meant them. ALE said that,

"It was very responsive and I felt that the responses it gave really accurate. The response made sense…. Just one occurrence when the robot did not really know what I was talking about"

The success of Botocrates in providing the users with the correct and needed information was the crux of the matter that led to their positive experiences. The five users (ALE, KAY, PAR, BAT and SES) found Botocrates to be a new source of information. Receiving new information, remembering the concepts and the terms related to the module, and getting new and different perspectives were among the successful and positive experiences mentioned by the users. ALE confirmed that:

"It helped me to remember what really actually I did throughout the coursework and that was helpful because it kept poking around different topics we did…… There are some situations where I did not know what terms he was referring to and what they meant so it actually gave definitions so that was really helpful."

KAY said:

"It has helped to understand some key terms….. It provided me with different opinions"

PAR stated:

"The chat helped me to remember some concepts and terms but it's not relevant to my assignments, which is probably why I couldn't remember it in the first place"

BAT pointed out that:

"It offered some definitions and the explanation of these definitions… It is really interesting to see different perspectives in our module apart from face to face and online seminars and chatting with the tutor"

After exploring users' levels of satisfaction, positive and negative experiences, let us examine the number of turns of each session compared with users' satisfaction. As we can see in *Table 61*, PAR and SES showed the lowest levels of satisfaction and made the fewest number of turns. On the contrary, ALE and KAY, who reported the highest levels of satisfaction, made the largest number of turns. However, drawing such a conclusion requires a large number of participants and more empirical evidence (Fischer, 2005, Collins, 2010).

NO	Session	NO of Botocrates' turns	NO users' turns	Users' satisfaction
1	ALE	34	34	8 out of 10
2	KAY	29	29	8 out of 10
3	PAR	14	14	5 out of 10
4	BAT	28	28	7 out of 10
5	SES	12	12	6.5 out of 10

Table 61: Number of users' turns and their levels of satisfaction

- *Difficulties and challenges facing users during the interaction with Botocrates*

The composition of contributions during the chat with Botocrates was the main challenge facing a non-native speaker who lacks the language skills needed for better communication. SES described constructing the correct structure of sentences during the interaction with Botocrates as a 'challenging' task. SES stated:

"For me, it was quite not hard but challenging when constructing my questions for making them clear for him to give good answer for me ....because my English is not good and I know that I have some problems maybe he does not understand what I asked him"

Such findings could highlight the potential advantages of Botocrates because such non-native speakers will be able to construct the sentences needed for interactions at their own pace (Walker and White, 2013). Spending time on constructing the contributions in turn could lead to a positive impact on users' language skills (Goodyear, 2000). According to Warschauer and Kern (2000), "the written nature of the discussion allows greater opportunity to attend and to reflect on the form and the content of the communication" (p.15).

In addition, ALE confirmed that he needed to be careful of his way of interaction as Botocrates might not be able to understand him. ALE said:

"As it is an artificial machine, it did not understand me when I said 'fire away' so you need to be very aware of the way you talk just because it might not catch up on your chat. So I think that would be apply when you talked to someone else"

The above statement of ALE can be seen as a part of the users' adaptation of the system which takes place when users adapt themselves to the designed system (Hasibi, 2012).

Both ALE and KAY admitted that the process of stating their own opinions is demanding. KAY and ALE's statements regarding Botocrates' *probe-opinion* moves were quoted and explained earlier in this chapter, see the section *conversational moves*.

- *Users' motivations to chat with Botocrates again and their purposes of interactions*

It seems that users' motivations to chat with Botocrates again are affected by their levels of satisfaction. While ALE, KAY and BAT showed motivation to use Botocrates again, SES and PAR were hesitant to express their willingness to do so. While ALE in response to the question "*whether you will chat with Botocrates again if he was available within the module*" said "*yes I think there is potential in this",* both KAY and BAT stated "*of course*". ALE described Botocrates as a useful tool for preparation. KAY and BAT pointed out some advantages of chatting with Botocrates such as the ease in getting information and the possibility to discover different perspectives and opinions related to the topics of the module. However, this is not the case with SES and PAR. SES stated:

"It depends what kind of opportunity I have. I really prefer to discuss with real people"

PAR pointed out that:

"Not sure. I prefer to discuss with my tutor or a fellow student who can respond more in depth to what I say"

It could be said that the perceived usefulness was not satisfactory enough to convince SES and PAR to use Botocrates again. Perceived usefulness can be defined as the degree to which users believe the interaction with Botocrates could meet their needs and enhance their performance (Albers, 2012). The perceived usefulness of the system is either positively or negatively associated with users' satisfaction (Jennex and Olfman, 2013). The continuous intention to use any system is connected to the users' satisfaction and their beliefs of the potential benefits that could lead to better performance (Davis, 1989). Here I would like to describe users' dissatisfaction as a snowball which is getting bigger and bigger as a result of users' negative experiences. This issue is extensively illustrated in the discussion section.

Discussion of findings

The aim of this section is to critically discuss the major empirical findings which resulted from the evaluation stage and their practical implications on the design of Botocrates. Before drawing any claims or final conclusions from the research findings, the limitations of the research study are pointed out and considered (Stangor, 2014, Johnson, 2015).

Task completion

The effectiveness of a new system can be evaluated by assessing task completion (Jürgen, 2006, Kunert, 2009). This section presents the discussion of findings related to the success of Botocrates in completing the tasks. Reaching the pedagogical aims is a key issue in a task-oriented pedagogical agent (Gulz et al, 2011). The section is divided into two sub-sections: a) providing information during information-seeking dialogues, b) users' engagement in the argumentation process, which represent the two established goals.

> If the chatbot is meant to be adapted to provide a specific service for users, then the best evaluation is based on whether it achieves that service or task.

(Abu Shawar and Atwell, 2007b, p.96)

a) Providing information during information-seeking dialogues

As illustrated in the analysis section, one of the main goals of users when interacting with Botocrates is to seek information and to find out answers to particular enquiries. The *Request-Info* moves constituted the highest number of their conversational moves during the interaction with Botocrates. As a result, information-seeking floors represented the highest number of conversational floors. Sadly, these moves uncovered some deficiencies in Botocrates' KB. The analysis of the logs extracted from the WOZ experiments showed that the success of Botocrates in helping users to achieve their interaction goals during the interactive questioning-answering tasks was limited to the amount of data stored in his Knowledge Base. The results from the users' interviews illustrated how such failure can negatively affect their levels of satisfaction with Botocrates. On the contrary, the users' positive experiences resulted from successfully providing the right required information. Avoiding failure of Botocrates in passing the required information demands an extensive effort in order to build an adequate and sufficient knowledge base (Walker et al, 2001, Quarteroni and Manandhar, 2007, Hastie, 2012).

I would argue that, for successful completion of information-seeking tasks, the designer of a conversational agent needs to take into account not only the quantity, but also the quality of the data produced to users. The analysis of users' interviews revealed that in some situations Botocrates' responses failed and did not achieve users' goals of interaction even though he successfully passed related information. It seems that the responses provided in such situations were not satisfactory because they did not fill the gaps in the users' information about particular topics. The users' initial goal of interaction is to search for information with intent to satisfy specific goals (Szczerbicki and Nguyen, 2009). Botocrates should present responses that carry new information to users so that they can recognize the potential benefits of Botocrates as a source of information (Zhang et al, 2014). Botocrates is required to provide rich information that enables users to broaden their knowledge connected to the domain of knowledge. At this point, it could be claimed that the domain expertise is an essential factor that can contribute to increasing the quality of the data stored in Botocrates' brain. The term *domain expert* "is used to identify individuals who have expert knowledge in a subject domain or field of study" (Zaborowski and Pittsburgh, 2008, p.19). Millett (2015) suggests that the domain expert can identify what is considered as rich, deep, and insightful knowledge. For example, during the interactions with Botocrates, users requested some recommendations and suggestions such as educational apps, websites, and e-activities. Ideally, the domain expert can provide answers to all such potential questions. Therefore, a domain expert should be consulted and asked to take part in the process of feeding the content of Botocrates' KB.

> Generally, through practice and experience, people develop strategies to guide the information seeking process… Domain expertise involves knowledge and skills related to the problem domain… Experts in a domain have extensive knowledge of the domain and have an organized knowledge base of the general problem area.
>
> (Schaie and Charness, 2003, p.120).

In addition to the above suggestion, for increasing users' levels of satisfaction in information-seeking tasks, Botocrates' dialogue strategies can be modified to include asking users whether the displayed information is satisfactory or not. This issue will be explained later in more detail, see *Dialogue performance*.

b) Users' engagement in the argumentation process

Engaging users in the argumentation process is the central aim of Botocrates. The findings showed the capability of Botocrates in creating situations where users' ideas were challenged to encourage them to articulate their lines of reasoning and defend their initial positions against any counter-arguments. The argumentative interactions occurred during two types of conversational floor: opinion-seeking floors initiated by users and *challenge to explain* floors initiated by Botocrates. The first sign that indicated the successful implementation of the argumentation process is the high level of active roles adopted by Botocrates during the interactions. It could be claimed that reporting the higher level of the agent's active role is essential, because it is believed to be one of the signs that indicate that the interaction goal in a task-oriented dialogue has been successfully achieved (Hajdinjak and Mihelic, 2004, Siddiqui, 2012). The active control enables the agent to direct the dialogue flow (Benesty, 2007).

As illustrated in the analysis section, *challenge to explain* floors represented the second highest number of floors compared to other types of floor. The analysis of Botocrates' conversational moves revealed the successful execution of *Probe-Opinion* moves followed by the set of argumentative moves*: Ask-clarify*, *Why-Question, Ask-Explain, Counter* moves. Such argumentative moves led users to be engaged in the argumentation process (Carr et al, 2005, Walton, 2006, Van Eemeren and Meuffels, 2009, Norman et al, 2013, Pilkington, 2015). The results confirmed the benefits of planting the seeds of an argument tree (*Probe-opinion* moves). The findings suggest that Botocrates successfully performed the first step of the process of planting these seeds to achieve the constructive expansions of exchange structures.

> Probing questions ask students to extend their knowledge beyond factual recall and parroting of learner answer, to apply what is known to what is unknown, and elaborate on what is known to deepen their understanding of this knowledge.
>
> (McTighe and Wiggins, 2013, p.56)

Another bright and encouraging result that supports the successful task completion related to users' engagement in the argumentation process is the high level of the role of 'critic' (challenging moves e.g. *Why-Question, Counter* moves) adopted by Botocrates (Pilkington, 1999, Kneser et al, 2001, Pilkington and Walker 2003a). It could be said the role of critic played by Botocrates during the interactions helped users to develop their assertions (*Inform-opinion* moves) into arguments by means of argumentation processes (Crosswhite, 2012, Walton, 2015a). Let us remember that one of the aims of Botocrates is to create situations where the process of argumentation can be internalized. During *challenge to explain* floors, Botocrates' cognitive train repeatedly passed through various cognitive territories (using the set of argumentative moves) to help users be familiar with them. The outcomes of the interaction between Botocrates and users showed that some users actively and positively adopted the roles of explainer, clarifier, and evaluator. Promoting students' critical thinking and argumentation skills involves creating activities that encourage them to adopt argumentation roles (Pilkington and Walker 2003a and 2003b, Reed and Norman, 2013, Cohen, 2015). Constrictive critiquing is believed to spark explanation and encourage evaluation (Cottrell, 2011, McAdoo, 2014).

However, it appears that planning the path of Botocrates' cognitive train and performing the activities on board are not the only challenging tasks of Botocrates. In other words, not all users accepted Botocrates' offer to be engaged in the process of *challenge to explain*. The findings revealed another challenging duty: the need to encourage users to get into the cognitive train of Botocrates. The process of argumentation is a joint activity in which Botocrates and users must feed the dialogue in order to achieve the development of the argumentation process (Walton, 2006, Anderiessen and Schwarz, 2009). The results from interviewing those users who did not engage in argumentative discussion with Botocrates uncovered two factors that contributed to such findings: a) users' goal of interaction, and b) users' attitudes towards

Botocrates. Some users conversed with Botocrates only for the purpose of getting specific information, which led them to initiate only information-seeking floors. In addition, negative attitudes towards a similar system could prevent users from enabling Botocrates to direct the flow of the dialogue towards the *challenge to explain* processes. Different research suggests that users' previous experience with other systems could affect their attitude toward the proposed system (Snodgrass, 2001, Sears and Jacko, 2009, Sia et al, 2011). In order to increase users' positive attitude towards Botocrates and the adoption of conversational behaviours that meet the goal of the design, future work should consider a) improving the performance of Botocrates, b) introducing the value and the benefits of Botocrates to users, and c) training users how to use Botocrates (Fung and Yuen, 2005, Guo and Zhang, 2011, Cruz-Cunha, 2013). In the section *Fostering users' attitudes*, these issues are explored in more detail.

In terms of opinion-seeking floors initiated by users, Botocrates was able to re-direct the questions to the users which enabled them to be engaged in a reflective practice. This floor was intended to deal with any *probe-opinion* moves initiated by users. Botocrates' dialogue strategies succeeded in encouraging users to be engaged in reflective practice by stating their positions and the lines of reasoning that led them to take such positions (Hedley et al, 2013, Bassot, 2015), which in turn could lead to more independent thinking processes (Lindhard, 1987, Moeller and Moeller, 2014).

I would like to emphasise the importance of the opinion-seeking floors initiated by users in terms of building a more concrete and comprehensive Knowledge Base and Academic Argumentation Bank in Botocrates' brain. Opinion-seeking floors initiated by users can be used to update and reconstruct the AAB to include more areas of *challenge to explain* floors. Any opinion-exchange topic can be utilized to construct either a simple (in case one position is identified connected to the topic) or a complex (in case two or more positions are identified) *challenge to explain* process including the nodes of positions and sub-nodes of support. This in turn will enable Botocrates to apply the same process of *challenge to explain* if opinion-exchange topics match the topics of *challenge to explain* floor.

> This is a matter of knowing the territory of the discipline, or at least of the topic. Once that territory is traversed via wide reading, reflection, discussion, and exploration of primary and secondary sources, the points of dispute tend to emerge.
>
> (Andrews, 2010, p.82)

Dialogue Performance

This section critically discusses the interpretation of the findings related to Botocrates' dialogue strategies. The focus of this section is the limitations of the current design of Botocrates' dialogue strategies, which suggest the need for further refinement. Revising and modifying Botocrates' dialogue strategies could lead to improving the overall dialogue performance (Pietquin, 2005, McTear and Raman, 2011, Heinroth and Minker, 2012). In order to increase users' successful experience with Botocrates, the dialogue strategies should be modified to avoid any interaction problems (Mencia et al, 2011).

The results from the analysis of the interviews revealed that there are certain responses provided to the users in information-seeking floors which were unsatisfactory. Such situations could create what I would call an 'unstable floor'. An unstable floor refers to a situation in which the response of the agent did not meet a user's need and expectation during an information-seeking floor. It could be said that the occurrence of such situation has a major negative consequence. The existence of unstable floors during the interactions can negatively affect users' attitudes towards Botocrates. Users' repeated unsuccessful experiences should be avoided because such experiences may prevent users from utilising Botocrates as a valuable tool (Shackel and Richardson, 1991, Shaw, 2000). In contrast, stable floors refer to situations in which Botocrates' responses successfully enable users to achieve their goals of interactions in information-seeking floors.

According to Levinson (1983) and Schegloff (1992, 2007), repair work aims to solve the problem resulting when the second part of a single adjacency pair (Botocrates' response) is dis-preferred or inappropriately stated. In a normal conversation, the repair work is presented in a third turn, which clearly expresses rejection or dissatisfaction (Sidnell, 2010). However, the findings from analysing the logs and interviews showed that some users did not initiate third turns to clearly express their dissatisfaction and left the interaction with negative experiences. Therefore, Botocrates' dialogue strategies need to be re-designed in order to increase users' satisfaction, because "a truly interactive system design supports the intended users in achieving their objectives" (Smith-Atakan, 2006, p.21). As Figure *51* shows, any *Give-info* move should be followed by a move that aims at checking users' satisfaction "*are you satisfied with this answer?*" *A check-satisfaction* move will continue until Botocrates does not have anything further to offer.

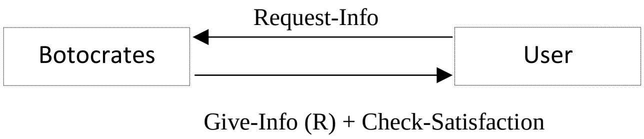


Figure 51: A check-satisfaction move

If Botocrates reached the point in which there is no more related information in his KB, then he will reply with the following response “*oops I have no answer, sorry my brain is under construction. I hope next time you will find the answer as the botmaster is continuously feeding my brain*” Followed by “*Would you like to ask me a question or should I select a topic of my area of interest?*” Different systems suggest that asking clarification questions to users could help in performing accurate actions that lead to achieving users’ goals of interaction (Jurafsky and Martin, 2009, Quarteroni and Manandhar, 2009, Andrews and Quarteroni, 2011, Zacarias and De Oliveira, 2012).

Another limitation of the current design of Botocrates is that in some situations *Close-C2E*’ (*Close-Challenge to Explain*) does not always mark the end of the *challenge to explain* floors. Therefore, a new move that checks the user’s readiness to close the current *challenge to explain* process e.g. “*Is there anything else you would like to say*?” is needed. If the user states ‘no’ or a similar meaning, then Botocrates will make an *Ex-St-Opener* move “*Would you like to ask me a question or should I select a topic of my area of interest?*” If the user responds by stating something related to the current exchange structure, Botocrates will perform a *feedback* move and invite the user to start a new exchange structure. It can be noticed that if the user says something unexpected the limitations of the current design emerge. Botocrates would succeed to deal with users’ conversational moves only if those interactional acts were addressed in his repertoire of dialogue strategies (Cassell, 2000). I have addressed this to the extent that I am able within the timescale of my research study. The modifications in Botocrates’ dialogue strategies are informed and shaped by the set of conversational behaviours adopted by participants during the experiments. However, such findings suggest the importance of further iteration, which must continue to discover other potential conversational behaviours (Syrdal et al, 1994, Dautenhahn, 2000). “The iterative nature of the design helps in overcoming limitations of the previous design and helps in improving the design” (Haideri, 2005, p.4). The iterative design process allows the developer to re-design the dialogue algorithms so that Botocrates' conversational acts could successfully address different users’ communicative actions (Minker et al, 2005). Iterative prototyping and successive refinement should be carried out until the problems of interaction are eliminated and users' satisfactions are achieved (Alavi and Umanath, 1989, Stephens, 2007).

> The choice of dialogue strategies is based on the best practice guidelines as well as experience, and can be amended as a result of a process of iterative design and testing.
>
> (McTear and Raman, 2004, p.371)

Botocrates' dialogue performance may face some criticism in terms of his technique related to the identification of an irrelevant premise (reason) fallacy. The logs analysis showed that in one event the content of the user of a *Give-reason* move could be seen as relevant, yet Botocrates classified it as 'irrelevant premises'. Let me break down this issue into three elements. The first is the impact of this reaction on the user's line of argument. By examining the impact of the utterance *'Is that relevant? Could you explain more?'* it can be concluded that such utterance encourages users to clearly state her/his support. Therefore, there is no major impact on the argumentation process. The second is the reason that lies behind such a reaction. This reaction is due to the approach adopted for building the nodes of positions and the sub-nodes of reasons (premises) in Botocrates' Academic Argumentation Bank (AAB). Botocrates' assessment of the line of reasoning relies on what are fed into his AAB as premises connected to a particular position. In other words, diagramming the argument in Botocrates' brain is limited to the identification of the set of positions, premises, and counter-arguments. But, this approach might be problematic. Halpern (2013) argues that argument diagramming and tracking the chain of argumentation in a complex argument is demanding.

> If the relation between premises and conclusion is not deductive, then some sense must be made of the claim that particular premises offer varying support for the conclusion. This cannot be accomplished through argument diagramming alone, especially if diagrams are limited to identifying premises and conclusions.
>
> (Weinstein, 1990, p.124)

It could be said that argument diagramming is the most effective technique which can be adopted for building Botocrates' AAB. Walton (2006) suggests that argument diagramming is extremely valuable if we could succeed in identifying the entire structure of the argumentation process (conclusion, premises, counter-argument). "Thus the use of the diagramming technique requires subtleties and skills of argumentation interpretation to be executed properly" (Walton, 1991). Third, in terms of the implications of these findings on the development of Botocrates' brain, we have to bear in mind that, the more Botocrates interacts with users the cleverer he becomes. I acknowledged that in chapter 5, section *6.5 Scenario and Dialogue Modelling*, after checking out the logs of interactions, in the case that the stated line of reasoning is relevant, Botocrates' AAB will be expanded (by the designer) to include the stated premises in the related sub-nodes of support. The logs resulting from the interactions between Botocrates and users could be recorded and revised in order to update his KB & AAB (Silvervarg, 2010, Brunelle and Denecke, 2011, Andrews and Quarteroni, 2011, Silvervarg and Jonsson, 2013, Sottilare et al, 2015).

Another result revealed from the interview analysis linked to dialogue performance is the rigid and formulaic responses presented by Botocrates during the interaction with users. Such findings can be attributed to the limited number of narrowly-restricted responses given to the wizard. The nature of the WOZ experiments could justify such findings because of the limited scope of the outputs given to the wizard during the experiments (Kerly and Bull, 2006). Using a limited number of expressions and responses for building Botocrates' KB and AAB is intended to lower the wizard's load. During the experiments, using the more rounded expressions needed for naturalising the interactions with users could lead to overloading the experimenter with tasks that may distract him from rigorously implementing the dialogue strategies (Dechesne et al, 2012). In order to naturalise the interactions between Botocrates and users, fuller, further, and richer outputs should be considered as a relevant suggestion and recommendation for my research study, see chapter 8, *8.4 Further work* and *Recommendations.*

Fostering users' positive attitudes

The key element for fostering users' positive attitudes towards Botocrates is improving his overall efficiency performance (Fung and Yuen, 2005), because "the success of the implementation of a new system depends enormously upon the design of the system" (Childe, 1996, p.223). If the system is poorly designed, users are likely to be discouraged from interacting with the system (Preece et al, 2015). Having said that, the findings revealed several areas that need to be given further consideration for enhancing users' attitudes towards Botocrates. The aim of this section is to explore some strategies that could sway or foster users' attitudes toward Botocrates.

The feedback obtained from users through interviews suggests that users' negative impressions about Botocrates can be attributed to two influences. The first factor is a user's held attitude towards similar systems, and the second one is the result of the user's negative experience during the interaction with Botocrates. One of the comments received indicated that Botocrates and similar computer-human interaction systems are applications that could be useful for people who have difficulty communicating and interacting with others but may not be of use to people who prefer direct interaction with their tutor and peers. Analysing the interaction between Botocrates and the user who made this comment revealed that the user kept asking and initiating new turns without giving the opportunity to Botocrates to direct the discussion towards the argumentation process. Users who hold negative attitudes are unlikely to make effective use of the new system (Smith, 1997). In addition, Fung and Yuen (2005) argue that prior negative attitudes could lead users to focus on the limitations of the new system. Therefore, there is a need to foster users' positive attitudes towards Botocrates by expounding the potential benefits of use (Brown et al, 2002). Explaining the possible advantages of interacting with Botocrates could lead to changes in the users' interactional behaviours. Users should be informed why interacting with Botocrates can enhance their performance (Verbeek and Slob, 2006, Shelly and Rosenblatt, 2011). It can be said that introducing the value of Botocrates to users is supported by adult learning theory 'the need to know' (Burton et al, 2015). Adult learners become more motivated and encouraged to do something if they are informed about its potential benefits (Stein and Farmer, 2004).

In terms of the negative experiences occurred during the interaction, it could be said that there is a mismatch of expectations. Some users expected Botocrates to be able to do things which he could not do, e.g. Botocrates could not understand the utterance '*fire away*'. Users could become frustrated about the interactions with Botocrates as the result of the mismatched expectations (Diaper and Stanton, 2003). Such findings suggest the need for user training. Training users how to use the new system during the interactions could contribute to reducing unpleasant experiences (Dwivedi, 2009). Users need to be trained what exactly Botocrates' functions are so that they can make efficient use of Botocrates. Karley and Bull (2006) suggest that training users how to interact with the agent could help in performing the tasks. For instance, users could be instructed to write precisely and clearly during the interactions. Lack of training may negatively affect the perceived usefulness of the new system and prevent users from making an objective evaluation (Barrier, 2001). For increasing the perceived usefulness of Botocrates, there is a need to avoid the causes that lie behind such negative experiences, and more importantly there is a need to increase the likelihood of users' positive experiences when interacting with Botocrates as well. Providing users with sufficient training and guidance about how they can engage in the *challenge to explain* process can help in fostering their positive attitudes. Users can be advised to state their opinions, lines of reasoning, disagreements etc. in clear and precise words. The findings showed that users who engaged in the *challenge to explain* processes reported positive and successful experiences. The positive experiences in turn could lead to enhancing users' beliefs about Botocrates' functional and utilitarian value (Peter and Beale, 2008, Freund and Cellary, 2014), which in turn could encourage them to continue using the system in the future (Davis, 1989).

7.4 Conclusion

This chapter presented the results and discussion of the findings of the evaluation stage. The two phases of the Wizard of Oz experiments have contributed to modifying and updating the initial design of Botocrates. The first set of the Wizard of Oz experiments, carried out with 2 users, revealed some drawbacks in both the content of Botocrates' knowledge base and his dialogue strategies. The content of Botocrates' knowledge base should be sufficient to answer any questions related to the domain of knowledge. The analysis of the interviews showed that users' levels of satisfaction are considerably affected by the capability of Botocrates in providing the wanted information. This work is limited to the timescale of the research, however, the designer should take into account the need for adequate time and effort to be given to build a more comprehensive and larger knowledge base. The pilot experiments also suggested several changes which need to be made in Botocrates' dialogue strategies in order to achieve the goal of promoting users' critical thinking and argumentation skills. Analysing the logs extracted from the first phase revealed the need to ask users to provide further explanation to help them to develop their lines of reasoning. In addition, Botocrates' tactics were updated to include a new move designed to encourage users to reflect on their line of argument at the end of the constructive expansion of the *challenge to explain* process.

The second set of the Wizard of Oz experiments was conducted with 5 users to execute the main evaluation of Botocrates. The findings from the main evaluation revealed that Botocrates performed better than the first round. In information-seeking tasks, Botocrates' level of success increased in terms of passing the required information to users. However, the interviews analysis revealed a crucial factor that should be considered by the developer of a conversational agent. Not only the quantity but also the quality of the information displayed to users is important. Users expect Botocrates to provide them with answers that broaden their knowledge. In this respect, the study suggests that domain experts should take part in the design so that users are satisfied with the agent and that their goals of interaction in information-seeking tasks are met. These domain experts could be consulted and asked to participate in building and shaping Botocrates' brain. Furthermore, Botocrates' dialogue strategies were modified to ensure users' satisfaction by clearly asking them whether his answer is satisfactory or not. In terms of users' engagement in the argumentation process, the results were encouraging. Botocrates was able to probe users' opinions and perform the set of conversational moves connected to the argumentation process. The success of Botocrates in playing the role of critic encouraged users to successfully adopt different roles of argumentation (the explainer, clarifier and evaluator). Users who engaged in argumentative discussion with Botocrates clearly stated and expressed their satisfaction with Botocrates.

The findings uncovered several points that needed to be addressed before users interact with Botocrates. Introducing the value and the potential benefits of Botocrates could lead to fostering positive attitudes towards Botocrates and eliminating any negative attitudes that may be held by users. In order to increase users' successful experiences, it would be better if they were guided and trained in terms of how to interact with the agent. Training users could align their expectations with the actual ability of Botocrates. The mismatch in expectations led to interaction problems. The results revealed that the mismatch between users' expectations and Botocrates' abilities can significantly affect their levels of satisfaction. Finally, central to increasing users' positive attitude and their intention to use Botocrates is the need to improve Botocrates' current capabilities. This in turn requires continuous iterative development and evaluation processes. The iterative design processes should last until a satisfactory version of Botocrates emerges, which is achieved when both the goal of the design and users' satisfaction are met.

Chapter Eight: Conclusions

This chapter draws conclusions, and identifies the main contributions of the work presented in this thesis. The chapter begins with a brief summary of the research, the major findings and the implications of the study. The second section outlines the main contributions. The limitations of this work and the methodological concerns are clearly acknowledged and presented in the third section. The fourth section aims to provide some recommendations and suggestions for further work arising from the study. The final section concludes the thesis with final words.

8.1 Summary of the research, the main findings and the implications

The study explored the use of a conversational agent (Botocrates) for supporting critical thinking and academic argumentation skills. The overarching questions of the study were:

- Can a conversational agent (Botocrates) support critical thinking and academic argumentation skills? If so, how?

To achieve the aim of the study it was necessary to design and evaluate a prototype that could implement the actual work of Botocrates. Therefore, Botocrates' prototype was created and evaluated in two different stages.

Stage one: Modelling Botocrates' prototype

The key research question of this stage was: 'what should go into the agent's 'brain' that is likely to promote critical thinking and academic argumentation skills?' The study in this stage identified three particular objectives needed to be achieved: finding out the tasks and sub-tasks of Botocrates; his dialogue strategies and tactics during the interaction; and exploring how the subject-specific domain of knowledge can facilitate the process of interaction.

The study gathered and analyzed 13 logs of students' online chats for building Botocrates' brain (dialogue content and strategies). The research, at this stage, applied the Discount scheme proposed by Pilkington (1999) to analyse students' interactions in three different levels: ESA, conversational moves, and turn-taking systems. Note that the justification for these procedures is fully articulated and explained in chapter 4, see *4. Methodology*.

The results from analysing students' online chats showed that students were not independently capable of starting the argument without the prompting of the tutor. The process of argumentation needs a starting point (Van Eemeren et al, 2007, Andrews, 2010). The study went deeper to examine when and how the argumentation process can be initiated. The analysis revealed that the generation of argument relied on '*probe*' moves. A '*probe*' move encouraged students to take positions and to state their opinions. Probing moves are central to establishing dialectical thinking (Walton, 1999, Rundquist, 2007, Grayling, 2010). Let us imagine the argumentation process as the tree and the student's position as the seed. It is important to identify where the seeds can be planted in order to allow these seeds to grow in a healthy environment. The study concluded that the area of dispute (different positions can be identified) and the sceptical area (one position can be identified and the other party merely raises a doubt) are the two areas where the argumentation process can be generated. While the first area can produce the complex structure of argument (claim + reason + counter-argument), the second one generates the minimum structure of argument (claim + reason). Identifying such areas is a matter of knowing the specific domain of knowledge.

The second stage of the argumentation process is challenging students' positions by asking the rationales behind taking positions (Walton, 2006). The analysis uncovered clear evidence of the preference of passive exchange roles amongst students in the online seminars. The passive roles adopted by students prevented them from arguing to learn. Most of the time, students failed to raise critical questions such as '*why do you think that*'. Probing students' perspectives were not necessarily followed by clearly articulated positions and stated reasons. Therefore, playing the active role by asking '*why*' questions is an essential sub-task of Botocrates. As a result of not challenging student's positions, student's chats contained some assertions and fallacies. The results also showed that there were some circumstances in which students could not clearly state their positions or they were reluctant to do so. In order to address these situations asking clarification questions and providing hints to students are important to the growth of the argumentation tree. Hint moves could enable students to take positions in the cases where students lack information about the topic under discussion (Pilkington and Walker, 2003a).

The students' interactions were often limited to the information-exchange level. The [I-R] type of exchange structure represented a high proportion of the total of exchange structure types with 79% compared to the other types during the students' interactions. The analysis revealed that most of the questions raised during the interaction needed a single reply to close the current exchange structure. Such questions would not enable students to be engaged in 'reflective thinking' (Dewey, 1910). Thus, the study claimed that two key factors could help students to be engaged in argumentation: a) the design of effective questions, and b) the level of scaffolding provided during students' interactions. These two elements are interrelated. While the design of effective questions allows the process of argumentation to start, scaffolding provides energy and fuel to the process of argumentation.

The findings showed that students in online chats were not engaging in dialectical and exploratory talk because such interactions require a certain degree of meaningful disagreement or contradiction where the justifications are articulated. Constructive disagreement can be created by means of a counter-argument. As illustrated earlier, counter argument can be found in the area of dispute where two or more positions can be taken.

By exploring the differences between passive and active explainer roles, the study found that students had a clear tendency to not state their line of reasoning unless they were challenged to do so. The study introduced the new concepts: a) '*challenge to explain*', and b) '*explain to challenge*' to help in diagnosing this problem.

On the one hand, *challenge to explain* refers to a situation in which a line of reasoning is stated as a response to others' explicit doubts and challenge questions. The explainer in this situation attempts to defend the stated claim or conclusion against the raised question because of the explicit doubt of other parties.

On the other hand, '*explain to challenge*' refers to a situation in the argumentation process where a claim or a conclusion is followed by a reason as a result of an implicit question and challenge raised by the same interlocutor. These implicit questions can be seen as a part of the speaker's awareness of the process of convincing others rationally. Such awareness or '*explain to challenge*' is the consequence of the internalisation of the argumentation processes. Note that the two new concepts are described and explained extensively in chapter 5, see section *Active and passive explainer roles.*

The study argued that '*explain to challenge*' can be seen as the outcome of the continuous practice of '*challenge to explain*'. Botocrates was informed that one of his tasks is engaging students constantly in the '*challenge to explain*' practice in order to guide students towards adopting the intellectual behaviour of '*explain to challenge*'.

In order to implement the process of *'challenge to explain'*, the notion of the '*constructive expansion of exchange structure'* was produced. The *'constructive expansion of an exchange structure'* aims to:

- Encourage a user to state her/his position clearly.

- Challenge the user to support the taken position by stating reasons.
- Help the user to avoid an assertion without evidence.
- Help the user to avoid fallacies during the argumentation process.
- Encourage the user to consider any counter-argument.
- Challenge the user to defend the taken position against any counter-argument or any counter evidence.

As can be noticed, the process of '*challenge to explain'* can be achieved by the practical implementation of the '*constructive expansion of exchange structure'*. Performing the expansion needs Botocrates to ask the right question based on the current circumstance, which in turn involves a dynamic process of detection and classification of the student's inputs.

Botocrates' main pedagogical goal during the process of *'challenge to explain'* is not to accept or reject students' positions, but to raise doubts about their positions in order to engage them in repeated and constant cycles of reflective thinking processes that could lead to the desired outcomes. When students are involved in such a process, they could reflect on their own arguments through the process of argumentation. Botocrates' approach gives emphasis to the importance of metacognitive skills that play an essential role in adopting the new strategies of argumentation and developing someone's own thinking (Halpern, 2003).

By considering the initial dialogue situation between Botocrates and users, Botocrates was designed to perform another task which is providing information related to the domain of knowledge. In case the user asks a question about the subject-matter knowledge, Botocrates provides the answer and then invites users to be engaged in the '*challenge to explain'* dialogue. In order to achieve these two tasks successfully, the dialogue strategies were designed to take into account the active roles in order to direct the flow of the interaction towards the ultimate goal. Botocrates' tactics included re-initiating and active switching from responding to initiating or re-initiating within the same turn to control the dialogue.

Based on different possible scenarios that may occur between Botocrates and users, the initial version of Botocrates' dialogue strategies and tactics was designed to deal with four types of dialogue floor: a) social conventions floor, b) information-exchange floor, c) probe-exchange floor, and d) '*challenge to explain'* floor. The 'floor' in conversation is defined as "a sustained focus of cognitive, verbal, and nonverbal attention and response between speaker and audience" (Erickson, 1982, p.47). It is recognized at the higher level of dialogue structure; higher than the level of turn and move (Hayashi, 1996). While the first three floors can be described as user-initiation floors, the last one (*'challenge to explain'*) is the Botocrates-initiation floor. In such a mixed initiative interaction both Botocrates and users can direct the flow of the chat. If a user initiates any turn that is not relevant to the above four floors, then Botocrates responds by performing a *Backchannel* move *"Uh-huh"* followed by a *Direct* move "*Let us chat about topics related to the Module EDUC5256M"* and an *Ex-St-Opener* move "*Would you like to ask me a question or should I select a topic of my area of interest?".* The moves that represent the communicative actions needed for addressing each dialogue floor were identified and the strategies were created in a set of tactics in order to deal with the current situations of the dialogue accordingly. Note that the full descriptions and justification of the conversational floors, dialogue process and the initial scenarios are clarified in further detail in chapter 6, see section *6.5 Scenario and Dialogue Modelling.*

By the end of this stage the objectives were achieved: the tasks and sub-tasks of Botocrates were identified, the rule-based dialogue strategies and tactics were created to reflect the identified tasks and sub-tasks, and finally the importance of specific domain knowledge in terms of the argumentation process were explored.

Stage two: The evaluation of Botocrates' prototype

The key research question of this stage was: 'What happens when students interact with Botocrates?' The study in this stage defined two specific objectives: investigating whether Botocrates succeeded in performing the tasks including students' engagement in the argumentation processes or not, and exploring students' feelings and satisfaction about Botocrates' performance.

The study employed two methods to achieve usability evaluation: the Wizard of Oz (WOZ) experiments (a human plays Botocrates' role) and interviews. 7 students participated in the evaluation stage. Each participant was interviewed immediately after the chat. The WOZ experiments were carried out in two phases. The first set of the WOZ was conducted with 2 users to test the initial version of Botocrates' prototype before carrying out the main evaluation. As a result of the initial evaluation, Botocrates' prototype was refined and modified to rectify the shortcomings of the initial design. Then, the second set of the WOZ experiments was conducted with 5 users which represents the main evaluation. Note that the procedures are fully justified and explained in chapter 4, see *4. Methodology*.

During the WOZ experiments, the wizard was provided with a decision tree to help him to classify users' inputs and rule-based dialogue strategies to guide him during the interaction. The wizard relied on two main databases: Botocrates' Knowledge Base (KB) and Academic Argumentation Bank (AAB). The first database contained the information needed during information-seeking floors initiated by users, and the second one contained the contents of the '*challenge to explain'* processes. Each '*challenge to explain'* process, in AAB, includes one position (in the case of a simple *challenge to explain* process) or nodes of positions (in the case of a complex *'challenge to explain'* process). While a simple *'challenge to explain'* refers to the argumentation process that emerges from the area of sceptical (where one position can be identified and Botocrates merely raises a doubt), a complex '*challenge to explain'* process refers to the argumentation process generated from an area of dispute (two or more positions can be taken). The wizard also was given additional databases that included the linguistic contents of conversational moves and ready or 'canned' feedback.

Botocrates' interface was designed to look like a real conversational agent in action, see chapter 4 section *Procedures of recording and collecting Wizard of Oz data*. The interaction between Botocrates and users took place on a platform within the Adobe Connect software. Each participant was allocated a different time slot to chat with Botocrates. Prior to the interaction, the participants were informed that the interaction covers only two units of the module (two & three) and they received the following instructions:

- Because my brain is under construction, the reply might take a few seconds before it appears on the screen.
- Please do not send two or more consecutive messages before I reply to the current one.
- You can start and end the chat anytime.

Also these instructions were displayed in the chat window.

The analysis of the logs extracted from the WOZ experiments was conducted in different levels: ESA, moves and conversational floors. In addition, the thematic analysis approach was used to analyse the interviews.

The findings from the first set of the WOZ experiments revealed that the wizard needed to undertake further training to achieve better accuracy during the interactions as his accuracy when implementing the dialogue strategies and tactics was only 90.4%. Before implementing the second set of the WOZ experiments, the wizard was extensively trained (11 training sessions). As a result the wizard's execution of the designed dialogue strategies during the main evaluation improved and his accuracy became 96%.

In terms of information-seeking floors, the first round of the WOZ experiments showed deficiencies in Botocrates' ability in terms of passing the requested information to users, as his unsuccessful *Give-info* moves accounted for 41% of the total numbers of *Give-info* moves. The participants who chatted with Botocrates in the first round attributed their low levels of satisfaction (one rated his satisfaction as 6 and the other participant as 7 out of 10) to Botocrates' failure in providing answers to some questions. In order to avoid such results and to increase users' level of satisfaction, Botocrates' KB was updated to include a comprehensive and larger knowledge base. Consequently, Botocrates' successful *Give-Info* moves increased in the main evaluation and represented 79% compared to unsuccessful ones that accounted for 21%.

However, users' interviews during the main evaluation uncovered another important issue that needed to be taken into account: the quality of information provided to users is as important as the quantity. Even though Botocrates successfully passed related information to users, some information was described by users (during the interviews) as not rich or not valuable. It appears that the answers provided by Botocrates in such situations were not satisfactory because these answers did not fill the gaps in users' knowledge. The results from users' interviews showed that Botocrates' failure can negatively affect their levels of satisfaction. Two of the users to whom Botocrates could not present 'satisfactory' answers (during the main evaluation) showed the lowest levels of satisfaction (one rated the level of satisfaction with Botocrates as 6.5 and the other 5 out of 10). In contrast, users' positive experiences resulted from successfully providing the right requested information. The success in providing the wanted information to users needs extensive efforts in order to create a sufficient knowledge base.

The study suggested that domain expertise is a central element, which could contribute to enhancing the quality of Botocrates' KB. A domain expert can determine what is seen as rich, deep, and insightful knowledge. In addition, Botocrates' dialogue strategies were modified to include a *Check-satisfaction* move (*Are you satisfied with this answer?*) after performing a *Give-info* move. In case a user states her/his dissatisfaction, Botocrates then retrieves another response related to the main enquiry from the KB followed by another *check-satisfaction* move. This process continues until the users' satisfaction is achieved or until there is no more related information found in Botocrates' KB. When Botocrates reaches the point in which he has no more information to offer, two moves need to be performed: an *apology* move and *Ex-St-Opener* move to invite users to start a new exchange structure.

Turning to engaging students in the argumentation process, the analysis of the logs extracted from the first set of the WOZ experiments suggested two refinements that were needed to be made to Botocrates' dialogue strategies. The first one is the need to encourage users to give a further explanation. The chats contained some situations in which users replied to a *'why'* question by writing a short comment. Botocrates' dialogue strategies were modified to include an *Ask-Explain* move, '*could you explain more*?' in reply to such comments. The user must state a line of reasoning that consists of at least two or more sub-nodes of reason stored in the AAB, associated with the position, otherwise the *Ask-explain* move will be performed. In addition, the dialogue strategies were modified to add a new move to ensure a better implementation of the *'challenge to explain'* process. At the end of each '*challenge to explain'* process, Botocrates' dialogue strategies were updated to include a '*Close-C2E*' move (*Close-Challenge to Explain* move). The purpose of this move was to: a) to enable a user to reflect on her/his line of argument connected to the '*challenge to explain'* floor and b) to close the '*challenge to explain'* floor. The '*Close-C2E*' move comprises of a summary of the line of reasoning and, in case of the complex '*challenge to explain'* processes, it also contains acknowledgment of the other side of the argument connected to the topic being discussed.

The analysis of Botocrates' conversational moves during the main evaluation showed the successful implementation of *Probe-Opinion* moves followed by the set of argumentative moves*: Ask-clarify*, *Why-Question, Ask-Explain*, *Counter* moves. The role of critic performed by Botocrates during the interactions enabled users to develop their assertions (*Inform-opinion* moves) into arguments through the argumentation processes. As a result of Botocrates' role of critic, the analysis showed that some users actively and positively adopted the roles of explainer, clarifier, and evaluator. The '*challenge to explain'* floors represented the second highest floors - 28% overall. Users who engaged in the *challenge to explain* process clearly expressed their satisfaction and they reported some benefits of Botocrates such as being a good tool of preparation and seeing things from different perspectives. Users who successfully engaged in the *challenge to explain* processes rated their satisfaction as 8 (two users) and 7 (one user) out of 10.

The main evaluation also revealed some limitations, and therefore, further development that is needed to be made to Botocrates' dialogue tactics related to the *challenge to explain* floors.

'*Close-C2E*' (*Close-Challenge to Explain*) did not always mark the end of the *challenge to explain* floor. Thus, another move is needed to be employed. Botocrates' dialogue strategies were modified to include a '*Check-readiness-to-C2E*' move *"Is there anything else you would like to say?"* Such moves can help in 'naturalising' the interaction by naturally directing the flow of the chat. The new strategies considered different conversational behaviours, see chapter 7, section *Conversational floor*.

However, not all users accepted Botocrates' offers to be engaged in the processes of argumentation. There were some events where the user only chatted with Botocrates for the purpose of getting answers about particular topics. Overall information-seeking floors initiated by users represented the highest number of conversational floors (40%) during the main evaluation. The analysis of the interviews showed that two factors contributed to such findings: a) users' goal of interaction, and b) users' attitudes towards Botocrates.

In order to foster users' positive attitudes towards Botocrates the future work should take into account: first, improving Botocrates' performance. The iterative development processes should continue until a satisfactory version of Botocrates' prototype is achieved, which emerges when the goal of the design and users' satisfaction are met. Second, introducing the value and the benefits of Botocrates to users. Explaining the potential benefits of Botocrates could lead to changes in users' interactional behaviours. Third, training users how to use Botocrates (e.g. training users to express their contributions e.g. question, position and reasons precisely and clearly) could contribute to reducing unpleasant experiences. Users need to be informed what exactly Botocrates' functions are and how to make an efficient use of Botocrates.

Note that this section aimed to provide a brief summary of the research, the main findings, and the implications. The arguments or claims stated above in this section are thoroughly supported by means of evidence and related literature reviews throughout this thesis.

8.2 Research outcomes and contributions

This section aims to present the theoretical and practical contributions of the study.

8.2.1 Challenge to explain and explain to challenge

The study has produced theoretical contributions to the field of critical thinking and academic argumentation in a number of ways. This work has presented a new understanding to the field regarding the process of promoting students' critical thinking and academic argumentation skills. The study produced the two new concepts: the '*challenge to explain'* and the '*explain to challenge'* to provide a better understanding of the importance of the gradual process needed for supporting students' critical thinking and academic argumentation skills. Producing academic arguments (the products) by means of academic argumentations (the processes) requires students to be involved in the '*explain to challenge'* process. Yet, the *'explain to challenge'* processes presuppose tools of thinking that need to be internalized into students' minds through repeated processes of the *'challenge to explain'* (the process of promoting critical thinking and academic argumentation skills).

In addition, the new terms: an '*implicit self-challenge'* and an '*explicit co-challenge'* were coined to describe the internal cognitive process of the '*explain to challenge'* and the external cognitive process of the '*challenge to explain'* respectively. The external cognitive process of the '*challenge to explain'* demands an '*explicit co-challenge'*. The process of an *'explicit co-challenge'* is a part of the scaffolding process needed to promote students' critical thinking and academic argumentation skills. When students are repeatedly subjected to the *'explicit co-challenge'* processes during the '*challenge to explain'* dialogues, the initializations of the argumentation process may occur by internally reconstructing such processes (including tools of thinking) in their 'internal plan'.

8.2.2 The constructive expansion of exchange structure

The study has produced the notion of the *'constructive expansion of exchange structure'* which is the practical implementation of the process of the '*challenge to explain'* dialogue. The constructive expansion of adjacency pairs within each cycle of *'challenge to explain'* process is designed to help students to internalize the process of argumentation. Producing the conceptual framework of the expansion occurred in the process of the *'challenge to explain'* shifts the attention from focusing on only a single adjacency pair (question/answer) to 'broader patterns' constituting the pedagogical purpose of promoting critical thinking and academic argumentation (*Probe-Opinion, Ask-Clarify, Why-Question, Ask-Explain, Counter* etc.). Preparing and executing the *'constructive expansion of the exchange structure'* can be understood when the argument is seen as a tree. The initial step of implementing the expansion is planting the seed of argumentation in an area of dispute (complex '*challenge to explain'*, where two or more positions can be taken) or area of scepticism (simple *'challenge to explain',* where one position can be taken and the other party in the dialogue only raises a doubt). The healthy growth of this seed starts when probing someone's perspective and encouraging her/him to clearly articulate the taken position. Then, challenging someone's position by raising critical questions e.g. '*why do you think that*' and encouraging her/him to consider any counter- arguments leads to the '*constructive expansion of the exchange structure*'. Through the process of constructive expansion, someone's assertion should be developed into arguments and any fallacies removed. By the end of the process of the '*constructive expansion of exchange structure*', students could reflect on the strength of their initial positions in the light of the elements of the argumentation processes. The scaffolding role during each phase of the '*constructive expansion of exchange structure*' was defined to create the '*explicit co-challenge*' zone.

The process of planning and implementing the sequence of questions within the same exchange structure can guide any attempt to enhance critical thinking and academic argumentation skills.

8.2.3 Botocrates' prototype

Several contributions were obtained as a result of Modelling and evaluating Botocrates' prototype:

- Botocrates' prototype has contributed to understanding whether a conversational agent such as Botocrates could be utilized to promote critical thinking and academic argumentation skills or not. Employing conversational agents for the purpose of promoting academic argumentation skills is no longer being described as an unknown or little-known educational practice. Botocrates' prototype established the baseline for a new intervention for supporting critical thinking and academic argumentation skills that could lead to better teaching and learning outcomes.
- The prototype defined the tasks and sub-tasks of the agent during the interactions with users: Information-seeking and the *'challenge to explain'* tasks and the sub-tasks necessary to achieve the identified main tasks were specified. While the information-seeking task reflects a student's initial goal for chatting with Botocrates, the *'challenge to explain'* task represents the ultimate goal of the design.
- Botocrates' prototype identified the dialogue acts, dialogue strategies and tactics needed to successfully perform the tasks and sub-tasks during the interactions with users. The design defined the conversational floors that may occur and explained how the dialogue strategies and tactics (purposeful moves) could contribute to achieving the tasks of interactions.

- The prototype clarified the role of the specific domain knowledge in achieving the tasks and sub-tasks. The importance of the quantity and the quality of the knowledge stored in the KB, in terms of both the agent's performance and users' satisfaction was clarified. In addition, the relationship between the domain of knowledge and the '*challenge to explain'* process is totally explored.
- The evaluation of the prototype with real users uncovered different users' conversational behaviours and attitudes. Users' conversational behaviours and attitudes played critical roles in refining and updating the initial version of Botocrates. A Real-user observation allowed the study to produce a set of interactional behaviours that need to be considered.
- An additional contribution to research are two research data-sets: the corpus of transcripts annotated with turn-types and the knowledge-base encoding the instructions for the Wizard-of-Oz. These are potentially useful in future research, for example to guide attempts to implement a fully automated version of Botocrates.

8.2.4 Naturalizing the interaction between Botocrates and users

The study has proposed some tactics (a set of purposeful moves) and conversational moves to naturalize the interaction between the agent and user.

- *Ex-St-Opener*: "*Would you like to ask me a question or should I select a topic of my area of interest?"*

Even though it might be argued that users can initiate new exchange structures at any time of the interaction, the above move helped in '*naturalising*' the flow of the interaction. Such a move could create what I have called a '*shared control*' state. A '*shared control*' state takes place when the agent who holds the current floor offers the initiative role to users. As a result of implementing the *Ex-St-Opener* move during the interaction, users were able to 'naturally' take the active role by initiating an information-seeking floor or other type of user-initiation floor. From such an innovation the study successfully investigated and uncovered when and why users dominate the *'shared control'* state and when and why the *'co-control'* state occurs. '*Co-control*' refers to the situation during the interaction where users give the opportunity to the agent to lead the chat.

Some other moves were proposed and integrated into Botocrates' dialogue strategies to naturalize the interaction:

- *Check-readiness-to-C2E*: "*Is there anything else you would like to say*?"
- *Check-satisfaction: "Are you satisfied with this answer"*

8.2.5 Stable and Unstable floors

Different classifications were proposed to categorize types of conversational floor. For example, the classification based on the types of participation or the development of conversational floors e.g. singly developed, collaborative, speaker-and-supporter, multiple conversational floor (see Edelsky, 1981, Shultz et al, 1982, Simpson, 2005a). The study has coined the new terms: '*stable'* and '*unstable'* floors which describe the two types of floor that take place within information-seeking tasks. My classification differs from other types of classification because it connects the outcomes of Botocrates' performance with users' levels of satisfaction. The findings from the interviews' analysis led the study to conclude that there are certain answers provided by Botocrates that created *'unstable floors'. 'Unstable floors'* can be found in situations in which the answers of Botocrates did not meet the user's expectation during the information-seeking tasks (even though related information was presented to users). The study found that the occurrence of such situations has major negative effects. The presence of '*unstable floors'* during the chat can negatively affect users' attitudes towards the agent and could lead them to reject Botocrates. Further, the study found that students who experienced '*unstable floors*' spent less time with the agent compared with users who experienced *'stable floors'*. *'Stable floors'* refer to situations in which Botocrates' responses successfully enable users to achieve their goals of interactions in information-seeking floors. *'Stable floors'* are important to users to accept Botocrates as a useful tool.

8.3 Limitations and methodological concerns

The purpose of this section is to present the limitations and methodological concerns of the study. Some limitations of the research study were controlled and addressed in order to increase the quality of the study, see chapter 4 section *4.6 The quality of the study*, yet there are some other limitations attributed to other factors that are beyond my ability to control, such as the constraints of time and the nature of the WOZ experiments.

As the study adopted the qualitative methodology and the WOZ experiments, there are some methodological limitations which should be pointed out.

A) Limitations related to the use of qualitative methods

The research study uses a small number of participants (Yin 2003, Breakwell, 2008, Willig, 2013, Jolley, 2013), and therefore, the sample of the study followed more purposive sampling strategies (Patton 1990, Patton, 2014, Bryman, 2012, Erford, 2014). Employing a small size of participants enabled me to investigate in-depth the data gathered from the first stage (the design stage) and the second stage (the evaluation stage) (Blaikie, 2009, Thomas, 2010, Stake, 2010). In addition, the rationale of using purposive sampling strategies was due to the nature of the investigation. The purposive sample was used in order to find participants who were willing to chat with Botocrates so that the interactions could be rich, which in turn allowed me to examine the chat in great detail (Creswell, 2013, Jones et al, 2013). However, because of the small number of participants during the second stage, the study was not able to claim complete coverage of the entire interactional behaviours that might be adopted by users.

B) Limitations related to using Wizard of Oz experiments.

The WOZ experiments might contain subjective selections of the wizard's responses (Sadowski, 2001), which could lead to inconsistent acts performed by the wizard (Hagethorn et al, 2008). To avoid the inconsistency of the wizard's actions during the experiments, extensive training sessions took place. Before implementing the experiments, the accuracy of the wizard's moves was measured in order to ensure a better level of execution of the dialogue strategies that reflect the design.

It could be argued that the results from the WOZ experiments are idealized because it is impossible for the wizard to simulate machine errors (Jurafsky and Martin, 2009, Xuan, 2013). During the experiments, the wizard simulates only Botocrates' dialogue strategies without considering further actions in the cases of grammatical and spelling mistakes that could be committed by users. Such restrictions were due to the nature of the WOZ experiments, in which the tasks given to the wizard needed to be manageable in order to be performed correctly (Kerly and Bull, 2006, Bernsen et al, 2012, Bourlard et al, 2014).

Having said that, the WOZ experiments achieved the aim of the study by successfully examining users' interactional behaviors and Botocrates' dialogue strategies and tasks completion.

8.4 Further work and recommendations

8.4.1 Botocrates' prototyping

The prototyping process of Botocrates must continue beyond the scope of this study in order to meet the ultimate aim of the design. The current prototype of Botocrates is less than a satisfactory one. The current executable model of Botocrates has its own limitations. The limitations arise from Botocrates' inability to deal with any conversational behaviours that were not previously addressed in his repertoire of dialogue strategies. If users say something unexpected the options of the current design are limited. I addressed this to the extent that I was able within the timescale of my doctoral study, but still this issue requires further investigations that were not possible to solve within a limited time. Therefore, some kind of algorithm where Botocrates' responses could be modified given fuller, further and richer input would be relevant suggestions for further work. Users' conversational behaviours are complex and they are difficult to predict. The iterative process of testing the design with more users and analysing the outcomes of interactions are essential for discovering, addressing and controlling users' conversational behaviours. The repeated cycles of evaluation and refinement help in addressing any existing flaws in Botocrates' prototype so that the desired functionality can be achieved.

The further work needs to consider also other recommendations and suggestions arising from this study that could lead to achieving a satisfactory version. For example, the outcomes of opinion-seeking floors initiated by users can be utilized to build more cycles of the '*challenge to explain'* processes. By analysing the area from which the user's probe-opinion move arises, the developer can create either simple or complex '*challenge to explain'* processes. Second, the domain experts can be asked to take part in the process of feeding Botocrates' KB to provide users with more rich, deep, and insightful answers. The future iterative evaluation process can examine the impact of employing the domain expert in conjunction with the use of a *'check-satisfaction'* move (*Are you satisfied with this answer?*). In addition, the future work can investigate the extent to which explaining and introducing the possible advantages of chatting with Botocrates to users can lead to changes in their interactional behaviours. The effects of training users on how to chat with Botocrates e.g. by encouraging them to write their contributions clearly and precisely during the interaction, should be examined as well.

8.4.2 Challenge to explain in different contexts.

The ultimate goal of students' engagement in the *'challenge to explain'* processes is to encourage them to adopt the *'explain to challenge'*. The *'challenge to explain'* processes could be employed in different contexts such as online or face to face interactions. The empirical investigation of the short-term and long-term impacts of the *'challenge to explain'* processes can be conducted in different educational settings. Further studies can empirically investigate the effects of engaging students in the *'challenge to explain'* process. Examining students' written essays by analysing their produced arguments (the products) before and after engaging students in the *'challenge to explain'* process can give us a better understanding of the impacts of such a process on students' work. In addition, exploring whether the long-term practice of the *'challenge to explain'* process leads students to adopt the more active explainer roles during the discussions or not could be a relevant suggestion for my research. There is a need for empirical evidence to support this novel hypothesis in order to gain a strong validation.

The idea of the '*challenge to explain'* process was born from the womb of a synchronous text-based chat. A further area of research can investigate employing the '*challenge to explain'* processes in text-based chats for promoting critical thinking and academic argumentation skills. Employing the '*challenge to explain'* processes during online chats could help in establishing dialectical dialogue between participants. E-moderators in online chats can plan and execute the notion of the '*constructive expansion of exchange structure'* as proposed in this study. Future studies can explore how the roles of the e-mediator and the chat's managers can be distributed and organized during the '*challenge to explain'* process to allow for the constructive *'explicit co-challenge'* zones to occur.

8.5 Final words

The use of a conversational agent for supporting critical thinking and academic argumentation skills was explored in this study. Before the study, there was no available working agent that could be used for conducting this investigation. The emergence of Botocrates' prototype has passed through several challenging tasks and tough times. The challenging task that emerged at the early stage was to find a context that could reflect the aim of the design. Unfortunately, there was no context that could reflect the dialogue contents and strategies. As Botocrates is the first agent who aims to achieve such a particular goal, there was a need to create an initial prototype to perform his intended tasks and sub-tasks. The study designed its own unique sets of dialogue strategies and tactics from scratch. The design of the prototype and the modifications made to the initial version of Botocrates relied on existing literature and real-users' observations.

Here I would like to clarify that, by the end of this study, a satisfactory version of Botocrates' prototype could not be obtained. But we have to bear in mind that this is the nature of designing any new system. When we were born, we could not run before being able to walk and Botocrates is so. Designing a new system involves analytical, empirical stages, and iterative processes of designing and development. Prototyping is the way of obtaining an early warning of the limitations of the design, the materials, and requirements needed to produce a better version of the design. Fail early and fail often would allow me to have a mature version of Botocrates. The final version relies on the work that needs to be performed in the future.

We need to keep motivated to pursue the goal of the design. Let us look on the bright side and the encouraging results obtained from this study. Botocrates' prototype was born during this study and, as a result, the critical success and failure factors related to the use of the conversational agent (Botocrates) to support critical thinking and academic argumentation skills were revealed. The initial corpus that reflects the goal of the design was generated, which could serve as training data for conversational system components. For keeping the same level of motivation and enthusiasm to pursue the goal of the design, we need to consider that the fields of HCI and AI are developing. And, therefore, if we succeed in overcoming the challenges facing the design of Botocrates, we can imagine Botocrates as an 'academic partner' for students who would be able to: provide rich, deep and insightful information, help students to explore the topics from different perspectives, and, more importantly, guide students towards the adoption of the *'explain to challenge'* processes.

References:

Aagesen, A., Anutariya, C. & Wuwongse, V. (2004). *Intelligence in Communication Systems*. Bangkok: Springer.

Abraham, A., Dote, Y., Furuhashi, T., Köppen, M., Ohuchi, A. & Ohsawa, Y. (2007). *Soft Computing as Transdisciplinary Science and Technology*. Berlin: Springer.

Abraham, B. & Williams, L. (2011). Expanding discourse options through computer- mediated communication: Guiding learners toward autonomy. *Foreign Language Annals*, 44, 626–645.

Abrahamsson, P., Marchesi, M. & Succi, G. (2006). *Extreme Programming and Agile Processes in Software Engineering*. Berlin Heidelberg: Springer.

Abu Shawar, B. & Atwell, E. (2004). Accessing an Information System by Chatting. In Meziane, F. & Métais, E. (Eds.). *Natural Language Processing and Information Systems: 9th International Conference on Applications of Natural Languages to Information Systems, NLDB 2004, Salford, UK, June 23-25, 2004, Proceedings*, Springer.

Abu Shawar, B. & Atwell, E. (2007a). Chatbots: Are they really useful? *LDV-Forum Band*, 22: 31-50.

Abu Shawar, B. & Atwell, E. (2007b). Different measurements metrics to evaluate a chatbot system. *Proc. of the 2nd Workshop on TextGraphs: Graph-Based Algorithms for Natural Language Processing, 2007.*

Abu Shawar, B. & Atwell, E. (2007c). Fostering language learner autonomy via adaptive conversation. *Proceedings of Corpus Linguistics 2007*.

Adler, E. & Clark, R. (2007). *How It's Done: An Invitation to Social Research*. Cengage Learning.

Ahrndt, S. & Albayrak, S. (2016). Joint Human-Agent activities: Challenge and Definition. In Klusch, M., Unland, R., Shehory, O., Pokahr, A. & Ahrndt, S. (Eds.). Multiagent System Technologies: 14th German Conference, MATES 2016, Klagenfurt, Österreich, September 27-30, 2016. Proceedings. Springer International Publishing.

Akerkar, R. (2014). *Introduction to Artificial Intelligence*. PHI Learning.

Alavi, M. & Umanath, N. (1989). Application Software Prototyping. In Kent, A. & Williams, G. (Eds.). *Encyclopedia of Computer Science and Technology: Volume 21 - Supplement 6: ADA and Distributed Systems to Visual Languages*. Taylor & Francis.

Albers, J. (2012). *Human-Information Interaction and Technical Communication: Concepts and Frameworks: Concepts and Frameworks*. Information Science Reference.

Aleixandre, M., Rodrigues, A. & Duschl, R. (1999). "Doing the lesson" or "doing science": Argument in high school genetics. *Science Education*, 84(6), 757-792.

Allen, R. & Perrault, C. (1979). Analyzing intention in utterances. *Artificial Intelligence*, 15 (1979), pp.143–178

Ally, M. (2004). Foundations of educational theory for online learning. In: Anderson T. & Elloumi, F. (Eds.). *Theory and practice of online learning.* Athabasca University.

Alston, P. (2000). *Illocutionary Acts and Sentence Meaning*. Cornell University Press.

Anastasiades, S. (2012*). Blended Learning Environments for Adults: Evaluations and Frameworks: Evaluations and Frameworks.* Information Science Reference.

Anathan, P., Wang, R. & Mihalidis, A. (2013). A Wizard of Oz and Mixed Methods Studies to inform Intelligent Wheelchair Design for Old Adults With Dementia. In Encarnação, P., Azevedo, L. & Gelderblom, J. (Eds.). *Assistive Technology: From Research to Practice: AAATE 2013*. IOS Press.

Anderiessen, J. & Schwarz, B. (2009).Argumentation Design. In Mirza, M. & Perret-Clermont, N. (Eds.). *Argumentation and Education: Theoretical Foundations and Practices*. Springer US.

Anderson, G. & Arsenault, N. (2005). *Fundamentals of Educational Research.* Taylor & Francis.

Anderson, J., Beard, F. & Walther, J. (2010). Turn-taking and the local management of conversation in a highly simultaneous computer-mediated communication system. *Language at Internet*, Volume 7 (2010).

Anderson, T. (2008). *The Theory and Practice of Online Learning.* University of Washington Press.

Anderson, W. & Krathwohl, R. (Eds.). (2001). *A taxonomy for learning, teaching and assessing: A revision of Bloom's Taxonomy of educational objectives.* New York : Longman

Andre, E. & Pelachaud, C. (2010). Interacting with Embodied Conversational Agent. In Chen, F. & Jokinen, K. (Eds.). *Speech Technology: Theory and Applications.* Springer US.

Andrews, P., De Boni, M. & Manandhar, S. (2006). Persuasive argumentation in human computer dialogue. In *Proceedings of the AAAI 2006 Spring, Symposium on Argumentation for Consumers of Healthcare*. Stanford University, California.

Andrews, P. & Quarteroni, S. (2011). Extending Conversational Agents for Task-Oriented Human-Computer in Dialogue. In Perez-Marin, D. (Eds.). *Conversational Agents and Natural Language Interaction: Techniques and Effective Practices: Techniques and Effective Practices*. IGI Global.

Andrews, R. (2009). *The importance of argument in education*. London: Institute of Education Publications.

Andrews, R. (2010). *Argumentation in Higher Education: Improving Practice Through Theory and Research.* Taylor & Francis.

Andriessen, J., Baker, M. & Sulthers D. (2013) Argumentation, Computer Support, and the Educational Context of Confronting Cognition. In Andriessen, J., Baker, M. & suthers, D. (Eds.). *Arguing to Learn: Confronting Cognitions in Computer-Supported Collaborative Learning Environments*. Springer Netherlands.

Antony, S. & Santhanam, R. (2008). Could the Use of a Knowledge-Based System Lead to Implicit Learning. In Burstein, F. & Holsapple, C. (Eds.). *Handbook on Decision Support Systems 1: Basic Themes*. Berlin Heidelberg: Springer.

Arboleda, C. (2003). *Writing a Thesis Proposal First Edition.* Rex Bookstore, Inc.

Arp, R. & Watson, C. (2015). *Critical Thinking: An Introduction to Reasoning Well*. Bloomsbury Publishing.

Arthur, C. (2012). *Creativity in Education and Learning: A Guide for Teachers and Educators*. Taylor & Francis.

Ary, D., Jacobs, L., Razavieh, A. & Sorensen, C. (2009). *Introduction to Research in Education*. Cengage Learning.

Atkinson, D. (1997). A critical approach to critical thinking in TESOL. *TESOL Quarterly,* 31(1), 71-94.

Atkinson, M. & Drew, P. (1979). *Order in Court: the Organisation of Verbal Interaction in judicial Settings*. London: Macmillan.

Atkinson, P., Delamont, S. & Housley, W. (2008). *Contours of Culture: Complex Ethnography and the Ethnography of Complexity*. AltaMira Press.

Aufschnaiter, C., Eduran, S., Osborn, J. & Simon, S. (2007).Argumentation and Learning of Science. In Pintó, R. & Couso, D. (Eds.). *Contributions from Science Education Research*. Springer Netherlands.

Aufschnaiter, C., Erduran, S., Osborne, J. & Simon, S. (2008). Arguing to Learn and Learning to Argue: Case Studies of How Students', Argumentation Relates to Their Scientific Knowledge. *Journal of Research in Science Teaching,* 45 (1). pp.101-131. ISSN 0022-4308.

Augello, A., Pilato, G., Machi, A. & Gaglio, S. (2012). An Approach to Enhance Chatbot Semantic Power and Maintainability: Experiences within the FRASI Project. *Semantic Computing (ICSC), 2012 IEEE Sixth International Conference*, pp.186 – 193.

Augello, A., Pilato, G., Vassallo, G. & Gagilo, S. (2013). Chatbots as Interface to Ontologies. In Gaglio, S. & Giuseppe, L. (Eds.). *Advances onto the Internet of Things: How Ontologies Make the Internet of Things Meaningful*. Springer International Publishing.

Austin, J. (1962). *How to Do Things with Words: J.L. Austin*. Clarendon Press.

Aveyard, H., Sharp, P. & Woolliams, M. (2011). *A Beginner's Guide to Critical Thinking and Writing in Health and Social Care*. McGraw-Hill Education.

Baek, J., Koh, E., Hoan, C. & Jeong, D. (2015). Authentic Thinking with Argumentation: Putting on the Thinking caps of Scientists and Designers. In Cho, H., Caleon, S. & Kapur, M. (Eds.). *Authentic Problem Solving and Learning in the 21st Century: Perspectives from Singapore and Beyond*. Springer Singapore.

Bailin, S. (2002). Critical thinking and science education. *Science & Education,* 11(4), 361–375.

Bailin, S., Case, R., Coombs, R. & Daniels, B. (1999). Conceptualizing critical thinking. *Journal of Curriculum Studies,* 31(3), 285–302.

Baker, M. (2009). Argumentative Interactions and the Social Construction of Knowledge. In Mirza, M. & Perret-Clermont, N. (Eds.). *Argumentation and Education: Theoretical Foundations and Practices.* Springer US.

Baker, P. & Ellece, S. (2011). *Key Terms in Discourse Analysis*. Bloomsbury Academic.

Ballagas, A. (2008). *Bringing Iterative Design to Ubiquitous Computing: Interaction Techniques, Toolkits, and Evaluation Methods*. Cuvillier.

Barnet, S. & Bedau. H. (2011). *Critical Thinking, Reading, and Writing: A Brief Guide to Argument.* Bedford: St. Martin's.

Baroni, P., Cerutti, F. & Simari, R. (2010). *Computational Models of Argument.* IOS Press.

Barres, D. (2012). *Technologies for Inclusive Education: Beyond Traditional Integration Approaches: Beyond Traditional Integration Approaches.* Information Science Reference.

Barrier, T. (2001). *Human Computer Interaction Development & Management*. IRM Press.

Bassot, B. (2015). *The Reflective Practice Guide: An interdisciplinary approach to critical reflection.* Taylor & Francis.

Batson, T. (2011). Situated learning: A theoretical frame to guide transformational change using electronic portfolio technology. *International Journal of ePortfolio*, 1(1), 107-114.

Baxter, K., Courage, C. & Caine, K. (2015). *Understanding Your Users: A Practical Guide to User Research Method.* Elsevier Science.

Beale, H. (1987). *A Pragmatic Theory of Rhetoric*. Southern Illinois University Press.

Bear, J. & McKool, S. (2009). How Rewards and Evaluations Can Undermine Creativity (and How to Prevent This). In Kaufman, B. & Kaufman, C. (Eds.). *The Psychology of Creative Writing.* Cambridge University Press.

Bel-Enguix, G., Dediu, A. & Lopez, M. (2009). A dialogue-Based Interaction System for Human-Computer Interfaces. In Hippe, S. & Kulikowski, L. (Eds.). *Human-Computer Systems Interaction: Backgrounds and Applications*. Berlin Heidelberg: Springer.

Benesty, J., Sondhi, M. & Huang, Y. (2007). *Springer Handbook of Speech Processing*. Berlin Heidelberg: Springer.

Bennett. B. (2013). *Denying the Antecedent. Logically Fallacious*. [Online] Available at: www.logicallyfallacious.com. [Accessed 25/06/2016].

Benoit, L. & Hample, D. (1992). *Readings in Argumentation.* De Gruyter.

Bensley, A. (1998). *Critical Thinking in Psychology: A Unified Skills Approach*. Brooks/Cole Pub.

Bente, G. & Kramer, C. (2011). Virtual gestures: embodiment and nonverbal behavior in computer-mediated communication. In Kappas, A. & Krämer, C. (Eds.). *Face-to-Face Communication over the Internet: Emotions in a Web of Culture, Language, and Technology*. Cambridge University Press.

Bento, J. (2004). *Collaborative Design and Learning: Competence Building for Innovation.* Praeger.

Benton, C. (2014). *Thinking about Thinking: Metacognition for Music Learning.* R&L Education.

Berg, M. (2015). NADIA: A Simplified Approach Towards the Development of Natural Dialogue Systems. In Biemann, C., Handschuh, S., Freitas, A., Meziane, F. & Métais, E. (Eds.). *Natural Language Processing and Information Systems: 20th International Conference on Applications of Natural Language to Information Systems.* Springer International Publishing.

Berger, A. & Pesty, S. (2005). Towards a conversational Language for Artificial Agents in Mixed Community. In Pechoucek, M., Petta, P. & Varga, Z. (Eds.). *Multi-Agent Systems and Applications IV: 4th International Central and Eastern European Conference on Multi-Agent Systems, CEEMAS 2005, Budapest, Hungary, September 15-17, 2005, Proceedings*. Berlin Heidelberg: Springer.

Bernsen, O., Dybkjaer, H. & Dybkjaer, L. (2012). *Designing Interactive Speech Systems: From First Ideas to User Testing*. London: Springer.

Beun, J., Baker, M. & Reiner, M. (1995). *Dialogue and Instruction: Modelling Interaction in Intelligent Tutoring Systems ; [proceedings of the NATO Advanced Research Workshop on Natural Dialogue and Interactive Student Modelling, Held in Varenna, Italy, October 17 - 20, 1992]*. Springer.

Beveridge, M. & Milward, D. (2003). Combining Task Descriptions and Ontological Knowledge for Adaptive Dialogue. In Matousek, V. & Mautner, P. (Eds.). *Text, Speech and Dialogue: 6th International Conference, TSD 2003, Ceské Budejovice, Czech Republic, September 8-12, 2003, Proceedings*. Berlin Heidelberg: Springer.

Bex, J. (2011). *Arguments, Stories and Criminal Evidence: A Formal Hybrid Theory*. Springer Netherlands.

Bickenbach, E. & Davies, M. (1996). *Good Reasons for Better Arguments: An Introduction to the Skills and Values of Critical Thinking*. Broadview Press.

Birner, J. (2012). *Introduction to Pragmatics*. Wiley.

Blackham, B., Jackson, F. & Probert, M. (2012). *Systems Thinking in Europe*. Springer US.

Blaikie, N. (2009). *Designing Social Research.* Wiley.

Blair, A. (2009). Informal Logic and Logic. *Studies In Logic, Grammar And Rhetoric*. ISBN 978–83–7431–206–6 ISSN 0860-150X.

Blair, A. & Tindale, W. (2011). *Groundwork in the Theory of Argumentation: Selected Papers of J. Anthony Blair.* Springer Netherlands.

Blandford, A. (1995). Deciding What to Say: An Agent-Theoretic Approach to Tutorial Dialogue. In Beun, R. J., Baker, M. & Reiner, M. (Eds.). *Dialogue and Instruction: Modelling Interaction in Intelligent Tutoring Systems ; [proceedings of the NATO Advanced Research Workshop on Natural Dialogue and Interactive Student Modelling, Held in Varenna, Italy, October 17 - 20, 1992].*Springer.

Blank, G. (2008). *Online Resaerch Method and Social Theory*. In Fielding, G., Lee, M. & Blank, G. (Eds.). *The SAGE Handbook of Online Research Methods*. SAGE Publications.

Blankenship, D. (2010). *Applied Research and Evaluation Methods in Recreation*. Human Kinetics.

Bok, D. (2008). *Our underachieving college.* Princeton*:* Princeton University Press.

Blömeke, S., Zlatkin-Troitschanskaia, O., Kuhn, C. & Fege, J. (2013). *Modelling and Measuring Competencies in Higher Education: Tasks and Challenges*. Sense Publishers.

Bloom, S. (1956a). *Taxonomy of Educational Objectives: The Classification of Educational Goals. Cognitive domain. Handbook 1*. David McKay.

Bloom, S. (1956b). *Taxonomy of Educational Objectives: The Classification of Educational Goals. Affective domain. Handbook 2*. David McKay.

Bloomberg, D. & Volpe, M. (2012). *Completing Your Qualitative Dissertation: A Road Map From Beginning to End*. SAGE Publications.

Bodomo, A. (2010). *Computer-mediated Communication for Linguistics and Literacy: Technology and Natural Language Education*. Information Science Reference.

Boeije, R. (2009). *Analysis in Qualitative Research*. SAGE Publications.

Bolcher, J. (2008). Computer-Mediated Communication: Enhancing Online Group Interactions. In Raisinghani, S. (2008). *Handbook of Research on Global Information Technology Management in the Digital Economy*. Information Science Reference.

Bonk, J. & Cunningham, J. (2006). Searching for Learner-Centered, Constructivist, and Sociocultural Components of Collaborative Educational Learning Tools. In Bonk, J. & King, K. (Eds.). *Electronic collaborators: Learner-Centred technologies for literacy, apprenticeship, and discourse.* Mahwah, NJ: Erlbaum.

Boostorm, E. (2005). *Thinking: The Foundation of Critical and Creative Learning in the Classroom*. Teachers College Press, Columbia University.

Boswell, C. & Cannon, S. (2014). *Introduction to Nursing Research: Incorporating Evidence-based Practice.* Jones & Bartlett Learning.

Boudy, S., Schlcogl, G., Chollet, P., Milhorat, J., Deslis, J., Feldmar, J. & Garschall, M. (2013). Using Wizard of Oz to Collect Interaction Data for Voice Controlled Home Care and Communication Services. *Proceedings of the IASTED SPPRA International Conference on Signal Processing. Pattern Recognition and Applications.*

Bourlard, H. & Popescu-Belis, A. (2014). *Multimodal Interactive Systems Management*. EFPL Press.

Bouwen, J. (2007). Beyond the User Interface. In Cornelis, J. & Wynants, M. (Eds.). *Brave New Interfaces: Individual, Social and Economic Impact of the Next Generation Interfaces.* Brussels University Press.

Bowell, T. & Kemp, G. (2014.) *Critical Thinking: A Concise Guide.* Taylor & Francis.

Bowles, H. & Seedhouse, P. (2007). *Conversation Analysis and Language for Specific Purposes*. Peter Lang.

Bradley, J., Mival, O., & Benyon, D. (2008). *A Novel Architecture for Designing by Wizard of Oz. Proceedings CREATE08,* London, June 2008.

Bradley, J., Mival, O. & Benyon, D. (2009). Wizard of Oz Experiments for Companions. In *Proceedings of the 2009 British Computer Society Conference on Human-Computer Interaction, pp.313–317. British Computer Society,* Swinton, UK (2009).

Brasdefer, C. (2015). The *Language of Service Encounters: A Pragmatic-Discursive Approach*. Cambridge University Press.

Braun, V. & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology,* 3 (2). pp.77-101. ISSN 1478-0887.

Braun, V. & Clarke, V. (2013). *Successful Qualitative Research: A Practical Guide for Beginners*. SAGE Publications.

Brazil, D. (1995). *A Grammar of Speech*. Oxford University Press.

Breakwell, M. (2008). *Doing Social Psychology Research.* Wiley.

Bricker, L. & Bell, P. (2011). Argumentation and Reasoning in life and in School: Implications for the design of school Science Learning Environments. In Khine, S. (Eds.). *Perspectives on Scientific Argumentation: Theory, Practice and Research.* Springer Netherlands.

Bringle, G., Hatcher, A. & Clayton, H. (2013). *Research on Service Learning: Conceptual Frameworks and Assessments*. Stylus Publishing.

Brinkman, W., Broekens, J. & Heylen, D. (2015). *Intelligent Virtual Agents: 15th International Conference, IVA 2015, Delft, The Netherlands, August 26-28, 2015, Proceedings.* Springer International Publishing.

Brkic, M., Matetić, M. & Kovačić. B (2009). VoiceXML Platform for Minority Languages. In Hippe, S. & Kulikowski, L. (Eds.). *Human-Computer Systems Interaction: Backgrounds and Applications*. Berlin Heidelberg: Springer.

Brook, S. (2008). Collaborative learning. In Orvis, K. L. (Eds.). *Computer-Supported Collaborative Learning: Best Practices and Principles for Instructors: Best Practices and Principles for Instructors*. Information Science Pub.

Brookfield, D. (1991). *Developing Critical Thinkers: Challenging Adults to Explore Alternative Ways of Thinking and Acting*. Wiley.

Brosche, M. (2010). *Successful Online Learning: Managing the Online Learning Environment Efficiently and Effectively*. Jones & Bartlett Learning.

Brown, A. (1997). Transforming schools into communities of thinking and learning about serious matters. *American Psychologist*, 52, 399–413.

Brown, C. (2008). *Developmental Psychology: A Course Companion*. SAGE Publications.

Brown, H. (2010). 'Exchange Structure in the Modern Classroom: 'Jamie's Dream School'. *Innervate Leading Undergraduate Work in English Studies*, 3, 31-56.

Brown, K. (1998). *Education, culture, and critical thinking*. Ashgate.

Brown, N. & Stockman, T. (2013). Examining the use of thematic analysis as a tool for informing design of new family communication technologies. *In Proceedings of the 27th international bcs human computer interaction conference (pp.21:1– 21:6), British Computer Society*. Swinton, UK

Brown. T. (2004). Bloom's Taxonomy and Critical thinking. In Weil, K. & Kincheloe, L. (Eds.). *Critical Thinking and Learning: An Encyclopedia for Parents and Teachers*. Greenwood Publishing Group Incorporated.

Brown, S., Massey A., Montoya-Weiss M., & Burkman J. (2002).Do I really have to? User acceptance of mandated technology. *European Journal of Information Systems*, 11(4), 283-295.

Browne, N. (2000). The importance of critical thinking for student use of the Internet. *College Student Journal*, 34(3), 391-398.

Browne, N. & Keeley, M. (2007). *Asking the Right Questions: A Guide to Critical Thinking*. Pearson Prentice Hall.

Brunelle, J. & Denecke, C. (2011). Natural Language Processing Tools. In Boonthum-Denecke, C. (Eds.). *Cross-Disciplinary Advances in Applied Natural Language Processing: Issues and Approaches: Issues and Approaches*. Information Science Reference.

Bruner, S. (1986). *Actual Minds, Possible Worlds*. Harvard University Press.

Bryman, A. (2012). *Social Research Methods*. OUP Oxford.

Buckner, D. (2007). *The Petitio in the syllogism.* [Online] Available at http://www.logicmuseum.com/hypothetical/britannicapetitio.html. [Accessed 25/06/2016].

Budgen. R. (2000). *Critical Thinking for Students: Learn the Skills of Critical Assessment and Effective Argument.* How To Books Ltd.

Bulter, H. (2015). Assessing Critical Thinking In Our Students. In Wegerif, L. & Kaufman, C. (Eds.). *The Routledge International Handbook of Research on Teaching Thinking*. Taylor & Francis.

Bunt, H. (2000). Dialogue pragmatics and Context specification. In Bunt, C. & Black, J. (Eds.). *Abduction, Belief, and Context in Dialogue: Studies in Computational Pragmatics*. Benjamins.

Bunt, H. (2013a). Requirement for Dialogue Context Modelling. In Bonzon, P., Cavalcanti, M. & Nossum, R. (Eds.). *Formal Aspects of Context.* Springer Netherlands.

Bunt, H. (2013b). Context-Change Semantic for Dialogue Acts. In Bunt, H., Bos, J. & Pulman, S. (Eds.). *Computing Meaning*. Springer Netherlands.

Burns, A. & Coffin, C. (2013). *Analyzing English in a Global Context: A Reader*. Taylor & Francis.

Burns, N. & Grove, K. (2010). *Understanding Nursing Research: Building an Evidence-Based Practice*. Elsevier Health Sciences.

Burton, D. (1981).Analysing spoken discourse. In Coulthard, M. & Montgomery, M. (Eds.) *Studies in Discourse Analysis*. London: Routledge & Kegan Paul.

Burton, S., Harris, H., Burrell, D., Brown-Jackson, K. & Bessette, D. (2015). Educational Edifices Need a Mobile Strategy to Fully Engage in Learning Activity. In Management Association. (Eds.). *Human-Computer Interaction: Concepts, Methodologies, Tools, and Applications: Concepts, Methodologies, Tools, and Applications*. IGI Global

Butler, M. & Christiansen, N. (1996). How to judge the quality of an argument. *Brigham Young university (BYU).*

Cabrio, E., Tonelli, S. & Villata, S. (2013). From Discourse Analysis To Argumentation Schemes and Back: relations and Differences. In Eite, J., Son, C., Torroni, P., Van Torre, L. & Woltran, S. (eds.). *Computational Logic in Multi-Agent Systems: 14th International Workshop, CLIMA XIV, Corunna, Spain, September 16-18, 2013, Proceedings.* Berlin Heidelberg: Springer.

Cai, Z., Feng, S., Baer, W. & Grasser, A. (2014). Instructional Strategies in Trialogue-based Intelligent Tutoring Systems. In Robert A., Sottilare, L., Graesser, M., Xiangen, M. & Goldberg, L. (Eds.). *Design Recommendations for Intelligent Tutoring Systems: Volume 2 - Instructional Management, U.S.* Army Research Laboratory.

Cakir, M. (2008). Constructivist approaches to learning in science and their implications for science pedagogy: A literature review. *International Journal of Environmental & Science Education*, 3(4), 193-206.

Calking A., Montero, A. & Kenji, A. (2007). Discovering Critically Self-Organized Chat. In Abraham, A., Dote, Y., Furuhashi, T., Köppen, M., Ohuchi, A. & Ohsawa, Y. (Eds.). *Soft*

Computing as Transdisciplinary Science and Technology: Proceedings of the fourth IEEE International Workshop WSTST´05. Springer.

Cam, P. (2006). *20 Thinking Tools: Collaborative Inquiry for the Classroom*. ACER Press.

Camilleri, M., Ford, P., Leja, H. & Sollars, V. (2007). *Blogs: Web Journals in Language Education.* Graz: European Centre for Modern Languages

Campos, P., Graham, N., Jorge, J. Nunes, N., Palanque, P. & Winckler, M. (2011). *Human-Computer Interaction -- INTERACT 2011: 13th IFIP TC 13 International Conference, Lisbon, Portugal, September 5-9, 2011, Proceedings.* Berlin Heidelberg: Springer.

Candlin, C. & Mercer, N. (2001). *English Language Teaching in Its Social Context: A Reader.* Routledge.

Carberry, S. (1990). *Plan Recognition in Natural Language Dialogue*. Bradford.

Carey, M. (1995).Comment: concerns in the analysis of focus group data. *Qualitative Health Research*. 5, 4, 487-495.

Carliner, S. (1999). *Overview of online learning.* Amherst, MA: Human Resource Development Press.

Carlson, L. (2012). *Dialogue Games: An Approach to Discourse Analysis*. Springer Netherlands.

Carr, F., Herman, N. & Harris, E. (2005). *Creating Dynamic Schools Through Mentoring, Coaching, and Collaboration*. Association for Supervision and Curriculum Development.

Carr, S. & Fulmer, L. (2004). *Educational Leadership: Knowing the Way, Showing the Way, Going the Way.* Scarecrow Education.

Carr, T., Cox, G., Eden, A. & Hanslo, M. (2004). From peripheral to full participation in a blended trade bargaining simulation. *British Journal of Educational Technology*, 35(2), 197-211.

Carrick, N. & Finsen, L. (1997). *The Persuasive Pen: An Integrated Approach to Reasoning and Writing.* Jones and Bartlett Publishers.

Carroll, D. (2013). *Skills for Academic and Career Success*. Pearson Higher Education AU.

Carroll, J. (2000a). *Making Use: Scenario-Based Design of Human-Computer Interactions*. MIT Press.

Carroll, J. (2000b). Five reasons for scenario-based design. *Interacting with computers*, 13, 1, 43-60.

Carston, R. (2008). *Thoughts and Utterances: The Pragmatics of Explicit Communication*. Wiley.

Cash, M. (2010). *Advancing Differentiation: Thinking and Learning for the 21st Century.* Free Spirit Publishing.

Cassell, J. (2000). *Embodied Conversational Agents*. MIT Press.

Cavazza, M., Smith, C., Charlton1, D., Crook, N., Boye, J., Pulman, S., Moilanen, K., Pizzi, D. & Turunen, M. (2010). Persuasive Dialogue Based on a Narrative Theory: An ECA Implementation. In Ploug, T. Hasle, P. & Oinas-Kukkonen, H. (Eds.). *Persuasive Technology: 5th International Conference, PERSUASIVE 2010, Copenhagen, Denmark, June 7-10, 2010, Proceedings*. Berlin Heidelberg: Springer.

Cawsey, A. (1992). *Explanation and Interaction: The Computer Generation of Explanatory Dialogues*. Bradford Book.

Cerrato, L. & Ekeklint, S. (2006). Evaluating Users' Reactions to Human-Like Interface. In Ruttkay, Z. & Pelachaud, C. (Eds.). *From Brows to Trust: Evaluating Embodied Conversational Agents.* Springer Netherlands.

Chaffee, J. (2014). *Thinking Critically*. Cengage Learning.

Chantarotwong, B. (2005). *The learning chatbot. IMS-256 Final Project*. [Online] Available at: http://courses.ischool.berkeley.edu/i256/f06/projects/bonniejc.pdf. [Accessed 01/09/2016].

Chaudhuri, S., Kumar, R., Howley, I. & Rosé, P. (2009). Engaging collaborative learners with helping agents. *Proceedings of the 14th international conference on Artificial intelligence*. Brighton, UK.

Chen, F. & Jokinen, K. (2010). *Speech Technology: Theory and Applications*. Springer US.

Chesla, L. (2005). *Reasoning Skills Success in Twenty Minutes a Day*. Learning Express, LLC.

Chesters, D. (2012). *The Socratic Classroom*. Sense Publishers.

Chiang, C. & Tomimatsu, K. (2011). The Effort of Social Networking on Social Behaviour-Integrating Twitter. Mobile Devices and Wearable Clothing as an Example. In Jacko, A. (Eds.). *Human-Computer Interaction: Towards Mobile and Intelligent Interaction Environments: 14th International Conference, HCI International 2011, Orlando, FL, USA, July 9-14, 2011, Proceedings*. Springer.

Childe, S. (1996). *An Introduction to Computer Aided Production Management.* Springer Netherlands.

Chin, C. & Osborne, J. (2010a). Students' questions and discursive interaction: Their impact on argumentation during collaborative group discussions in science. *Journal of Research in Science Teaching*, 47(7): 883–908.

Chin, C. & Osborne, J. (2010b). Supporting argumentation through students' questions: Case studies in science classrooms. *The journal of the learning sciences*, 19(2), 230-284.

Chinn, C. & Clark, D. (2013). Learning Through Collaborative Argumentation. In Hmelo-Silver, C., Chinn, C., Chan, C. & O'Donnell, M. (Eds.). *The International Handbook of Collaborative Learning.* Taylor & Francis.

Chipman, S. & Meyrowitz, L. (2012). *Foundations of Knowledge Acquisition: Cognitive Models of Complex Learning*. Springer US.

Christie, M., Rowe, P., Perry, C. & Chamard, J. (2000). Implementation of realism in case study research methodology. In *the International Council for Small Business, Annual Conference.* Brisbane, Australia.

Cioffi, L. (2009). *The Imaginative Argument: A Practical Manifesto for Writers*. Princeton University Press.

Clark, B., Sampson, D., Stegmann, K., Marttunen, M., Kollar, I., Janssen, J., Weinberger, A., Menekse, M., Erkens, G. & Laurinen L. (2010). Online learning environments, scientific argumentation, and 21st century skills. In Ertl, B. (Eds.). *E-Collaborative Knowledge*

Construction: Learning from Computer-Supported and Virtual Environments. Information Science Reference.

Clark, C. & Mayer, E. (2011). *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning.* Wiley.

Clark, H. & Schaefer, F. (1989). Contributing to discourse. *Cognitive Science*, 13, 259–294.

Clark, M. (1980). *The place of syllogistic in logical theory.* University of Nottingham monographs in the humanities. Nottingham University Press, Nottingham. ISBN 0900592590.

Clarke, P. (2000). The Internet as a medium for qualitative research. In *Web 2000 Conference.* Rand Afrikaans University. Johannesburg, South Africa.

Clayman, S. & Heritage, J. (2002). *The News Interview: Journalists and Public Figures on the Air*. Cambridge University Press.

Clough, P. & Nutbrown, C. (2002). *A Student's Guide to Methodology: Justifying Enquiry*. SAGE Publications.

Coch, D., Fischer, W. & Dawson, G. (2010). *Human Behavior, Learning, and the Developing Brain: Typical Development*. Guilford Press.

Cogan, R. (1998). *Critical Thinking: Step by Step*. University Press of America.

Cohen, D. (2015). Missed Opportunities in Argument Evaluation. In Van Eemeren, H. (Eds.). *Reflections on Theoretical Issues in Argumentation Theory.* Springer International Publishing.

Cohen, L, Manion, L. & Morrison, K. (2013). *Research Methods in Education*. Taylor and Francis.

Cohen, M. (2015). *Critical Thinking Skills For Dummies*. Wiley.

Cohen, P. (1997). Dialogue Modelling. In Varile, B. & Zampolli, A. (Eds.). *Survey of the State of the Art in Human Language Technology*. Cambridge University Press.

Cohen, P. & Perrault, R. (1979). Elements of a plan-based theory of speech acts. *Cognitive Science*, 3(3):177- 212.

Collins, H. (2010). *Creative Research: The Theory and Practice of Research for the Creative Industries*. Bloomsbury Academic.

Connolly, H. (1997). *Discourse and Pragmatics in Functional Grammar.* Mouton de Gruyter.

Cook, G. (1989). *Discourse*. OUP Oxford.

Cooke, W. (2007). *Frontiers in Higher Education.* Nova Science Publishers.

Cornelius, L., Herrenkohl, R. & Wolfstone-Hay, J. (2013). Organizing collaborative learning experiences around subject matter domains: The importance of aligning social and intellectual structures in instruction. In Homelo-Silver, E., Chinn, C., Chan, C. & O'Donnell, M. (Eds.). *The International Handbook of Collaborative Learning.* Taylor & Francis.

Costa, L. & Kallick, B. (2013). *Dispositions: Reframing Teaching and Learning*. SAGE Publications.

Cottrell, S. (2011). *Critical Thinking Skills: Developing Effective Analysis and Argument.* Palgrave Macmillan.

Coulthard, M. (2013). *Advances in Spoken Discourse Analysis.* Taylor & Francis.

Coulthard, M. & Brazil, C (1981). Exchange Structure. In Coulthard, M. & Montgomery, M. (Eds.) *Studies in Discourse Analysis, London*. Boston-Henly: Routledge & Kegan Paul.

Coulthard, M. & Brazil, C. (1992). Exchange structure. In Coulthard, M. (Eds.). *Advances in spoken discourse analysis*. London: Routledge.

Cox, G., Carr, T. & Hall, M. (2004). Evaluating the use of synchronous communication in two blended courses. *Journal of Computer Assisted Learning* 20, 183–193.

Crawford, A. (2005). *Teaching and Learning Strategies for the Thinking Classroom*. International Debate Education Association.

Creswell, W. (2012a). *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research*. Pearson.

Creswell, W. (2012b). *Qualitative Inquiry and Research Design: Choosing Among Five Approaches.* SAGE Publications.

Creswell, W. (2013). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches.* SAGE Publications.

Crockett, K., O'Shea, J. & Bandar, Z. (2011). Goal Orientated Conversational Agents: Application to Benefit Society. In O'Shea, J., Nguyen, T., Crockett, K., Howlett, J. & Jain, C. (Eds.). *Agent and Multi-Agent Systems: Technologies and Applications: 5th KES International Conference, KES-AMSTA 2011, Manchester, UK, June 29 -- July 1, 2011, Proceedings.* Berlin Heidelberg: Springer.

Crosswhite, J. (2012). *The Rhetoric of Reason: Writing and the Attractions of Argument*. University of Wisconsin Press.

Cruz-Cunha, M. (2013). *Handbook of Research on ICTs and Management Systems for Improving Efficiency in Healthcare and Social Care*. IGI Global.

Cuban, L. (1984). Policy and research dilemmas in the teaching of reasoning: Unplanned designs. *Review of Education Research,* 54(4), 655-681.

Cummings, L. (2010). *The Routledge Pragmatics Encyclopedia*. Taylor & Francis.

Cutting, J. (2005). *Pragmatics and Discourse: A Resource Book for Students*. Taylor & Francis.

Cypher, A. & Halbert, C. (1993). *Watch what I Do: Programming by Demonstration.* MIT Press.

Dabbag, N. & Kitsantas, A. (2013). Using Learning Management Systems as Metacognitive Tools to Support Self-Regulation in Higher Education Context. In Azevedo, R. & Aleven, V. (Eds.). *International Handbook of Metacognition and Learning Technologies*. New York: Springer.

Dale, R., Aliod, M. & Rolf, S (2003).Natural Language Processing in the Undergraduate Curriculum. In *Proceedings of the Fifth Australasian Computing Education Conference (ACE2003), 4th–7th February.* Adelaide, South Australia.

Dam, G. & Volman, M. (2004). Critical thinking as a citizenship competence: teaching strategies. *Learning and Instruction*, 14, 359-379.

Damer, T. (2008). *Attacking Faulty Reasoning: A Practical Guide to Fallacy-Free Arguments*. Cengage Learning.

Daniel, S. & Sam, G. (2011). *Research Methodology*. Gyan Publishing House.

Dascalu, M. (2013). *Analyzing Discourse and Text Complexity for Learning and Collaborating: A Cognitive Approach Based on Natural Language Processing*. Springer International Publishing.

Dautenhahn, K. (2000). *Human Cognition and Social Agent Technology*. John Benjamins.

Dautenhahn, K. & Saunders, J. (2011). *New Frontiers in Human–Robot Interaction.* John Benjamins Publishing Company.

Davies. A. (2007). *What is Assessment for learning? Assessment for learning: An online resource for educators.* [Online] Available at: http://annedavies.com/assessment_for_learning_wafl.html. [Accessed 29/06/2016].

Davies, A. & Elder, C. (2008). *Handbook of Applied Linguistics*. Wiley.

Davies, B. & Hughes, N. (2014). *Doing a Successful Research Project: Using Qualitative Or Quantitative Methods*. Palgrave Macmillan.

Davis, D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3): 319-339.

Davies, M. (2004). In defence of generalisation: Moore on the critical thinking debate. *Higher Education Research and Development*.

Davies, M., Brennan, M. & Vourvachis, P. (2014). Content Analysis and Discourse Analysis in Corporate Narrative Reporting Research: A Methodological Guide. *Bangor Business School, Bangor University.*

Dawn, T., Harkin, J. & Turner, G. (2013). *Teaching Young Adults: A Handbook for Teachers in Post-Compulsory Education*. Taylor & Francis.

Daykin, N. & Stickly, T. (2015). The role of qualitative research in arts and health. In Camic, M. (Eds.). *Oxford Textbook of Creative Arts, Health, and Wellbeing: International Perspectives on Practice, Policy and Researc.* Oxford University Press.

De Almeida, G. (1985). Pragmatic Universals And Communicative Action. In Dascal, M. & Cuyckens, H. (Eds.). *Dialogue: An Interdisciplinary Approach*. John Benjamins Publishing Company.

De Gasperis, G. & Florio, N. (2012). Learning to Read/Type a Second Language in a Chatbot Enhanced Environment. In Vittorini, P., Gennari, R., Marenzi, I., De la prieta, F. & Rodríguez, C. (Eds.). *International Workshop on Evidence-Based Technology Enhanced Learning*. Berlin Heidelberg: Springer.

De Vaus, A. & De Vaus, D. (2001). *Research Design in Social Research*. SAGE Publications.

Deci, L. & Ryan, M. (1987). *The support of autonomy and the control of behavior. Journal of Personality and Social Psychology*, 53, 1024-1037.

Dechesne, F., Hattori, H., Mors, A., Such, M., Weyns, D. & Dignum, F. (2012). *Advanced Agent Technology: AAMAS Workshops 2011, AMPLE, AOSE, ARMS. DOCM3AS. ITMAS.* Berlin Heidelberg: Springer.

Denscombe, M. (2014). *The Good Research Guide: For Small-Scale Social Research Projects.* McGraw-Hill.

D'errico, F., Poggi, I., Vinciarelli, A. & Vincze, L. (2015). *Conflict and Multimodal Communication: Social Research and Machine Intelligence*. Springer International Publishing.

Devault, D. & Stone, M. (2014). Pursuing Understanding in Dialogue. 2014. In Stent, A. & Bangalore, S. (Eds.). *Natural Language Generation in Interactive Systems*. Cambridge University Press.

Dewey, J. (1910). *How we think*. Boston: D.C. Health.

Diaper, D. & Stanton, N (2003). *The Handbook of Task Analysis for Human-Computer Interaction*. CRC Press.

Dicks, W., Mason, B. & Coffey, A. (2006). Ethnography and data reuse: issues of context and hypertext. Methodological issues in qualitative data sharing and archiving. *Qualidata*. [Online] Available at: http://www.cf.ac.uk/socsi/hyper/QUADS/working_papers.html. [Accessed 10/02/2015].

Digion, L. & Sosa, M. (2012). Conceptual Integration of Usability and Communicability for the Interface Maintenance of E-learning Type Collaborative Systems. In Ficarra, C. (Eds.). *Human-Computer Interaction, Tourism and Cultural Heritage: Second International Workshop, HCITOCH 2011, Cordoba, Argentina, September 14-15, 2011, Revised Selected Papers*. Berlin Heidelberg: Springer.

Dino, H. & Chella, A. (2013). What Will You Do Next? A Cognitive Model for Understanding Others' Intentions Based on Shared Representations. In Shumaker, R. (Eds.). *Virtual, Augmented and Mixed Reality: Designing and Developing Augmented and Virtual Environments: 5th International Conference, VAMR 2013, Held as Part of HCI International 2013, Las Vegas, NV, USA, July 21-26, 2013, Proceedings.* Berlin Heidelberg: Springer.

Dix, A., Finlay, J., Abowd, D. & Beale, R. (2004). *Human Computer Interaction.* Harlow, UK: Addison-Wesley.

Donnelly, R. (2008). *Applied E-Learning and E-Teaching in Higher Education.* Information Science Reference.

Donovan, S. & Bransford, D. (2005). *How Students Learn: History in the Classroom.* National Academies Press.

Dorn, M. (1999). *Mind in Art: Cognitive Foundations in Art Education*. Taylor & Francis.

Dottin, S. (2009). *Dispositions as Habits of Mind: Making Professional Conduct More Intelligent*. University Press of America.

Douglas, J. (2013). *In the Spirit of Critique: Thinking Politically in the Dialectical Tradition.* State University of New York Press.

Drew, P. & Heritage, J. (1992). *Talk at Work: Interaction in Institutional Settings*. Cambridge University Press.

Driver, R., Newton, P. & Osborne, J. (2000). Establishing the norms of scientific argumentation in classrooms. *Science Education*, 84(3), 287-312.

Druin, A. (2009). *Mobile Technology for Children: Designing for Interaction and Learning.* Elsevier Science.

Duff, P. (2012). *Case Study Research in Applied Linguistics*. Taylor & Francis.

Duncan, K., Kenworthy, A. & McNamara, R. (2012). The Effect of Synchronous and Asynchronous Participation on Students' Performance in Online Accounting Courses. *Accounting Education*, 21(4), 431–449.

Dunkels, E. (2011). *Interactive Media Use and Youth: Learning, Knowledge Exchange and Behavior: Learning, Knowledge Exchange and Behavior.* Information Science Reference.

Duplessis, G., Chaignaud, N., Kotowicz, J., Pauchet, A., & Pecuchet, J. (2013). Empirical Specification of Dialogue Games for an Interactive Agent. In Demazeau, Y., Ishida, T., Rodríguez, C. & Pérez, B. (Eds.). *Advances on Practical Applications of Agents and Multi-Agent Systems: 11th International Conference, PAAMS 2013, Salamanca, Spain, May 22-24, 2013. Proceedings.* Berlin Heidelberg: Springer.

Dwivedi, N. (2009). *Handbook of Research on Information Technology Management and Clinical Data Administration in Healthcare*. IGI Global.

Dybkjær, L., Hemsen, H. & Minker, W. (2007). *Evaluation of Text and Speech Systems*. Springer Netherlands.

Ebersohn, L. & Eloff, I. (2004). *Keys to Educational Psychology*. Juta, Limited.

Edelsky, C. (1981). Who's got the floor? *Language in Society,* 10/3, 383 – 421.

Edmondson, W. (1981). *Spoken discourse: a model for analysis*. Longman Publishing Group.

Edwards, R. & Holland, J. (2013). *What is Qualitative Interviewing?* Bloomsbury Publishing.

Eggins, S. & Slade, D. (2005). *Analysing Casual Conversation*. Equinox.

Elder, L. & Paul, R. (1998). The Role of Socratic Questioning in Thinking, Teaching, and Learning. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas,* 71:5, 297-301.

Ellis, R. (2012). *Language Teaching Research and Language Pedagogy*. Wiley.

Elragal, A. & Birry, D. (2011). Factor Influencing Users' Intention to Continue Using ERP System. In Cruz-Cunha, M. & Varajao, J. (Eds.). *Enterprise Information Systems Design, Implementation and Management: Organizational Applications*. Business Science Reference.

Enfield, J. (2009). *The Anatomy of Meaning: Speech, Gesture, and Composite Utterances.* Cambridge University Press.

Ennis, H. (1985). A logical basis for measuring critical thinking skills. *Educational Leadership*, 43(2), 44–48.

Ercikan, K. & Roth, M. (2009). *Generalizing from Educational Research: Beyond Qualitative and Quantitative Polarization.* Taylor & Francis.

Erduran, S. & Osborne, J. (2004). Developing Arguments. In Alsop, S., Bencze, L. & Pedretti, E. (Eds.). *Analysing Exemplary Science Teaching*. McGraw-Hill Education.

Erford, B. (2014). *Research and Evaluation in Counseling.* Cengage Learning.

Erford, B. (2016). *An Advanced Lifespan Odyssey for Counseling Professionals*. Cengage Learning.

Erickson, F. (1982). Money tree, lasagna bush, salt and pepper: Social construction of topical cohesion in a conversation among Italian-Americans. In Tannen, D. (Eds.). *Analyzing discourse: Text and talk*. Washington DC: Georgetown University Press.

Esposito, F. (2005). *Innovations in Applied Artificial Intelligence: 18th International Conference on Industrial and Engineering Applications of Artificial Intelligence and Expert Systems, IEA/AIE 2005, Bari, Italy, June 22-24, 2005, Proceedings*. Berlin Heidelberg: Springer.

Evers, M. & Nijholt, G. (2003). A Jacob- An Animated Instruction Agent In Virtual Reality. In Tan, T., Shi, Y. & Gao, W. (2eds.). *Advances in Multimodal Interfaces - ICMI 2000: Third International Conference Beijing, China, October 14-16, 2000 Proceedings.* Berlin Heidelberg: Springer.

Fabian, A., Hernandez, M., Pineda, L. & Meza, I. (2011a). Contextual Semantic Processing for a Spanish Dialogue System Using Markov Logic. In Batyrshin, I. & Sidorov, G. (Eds.). *Advances in Artificial Intelligence: 10th Mexican International Conference on Artificial Intelligence, MICAI 2011, Puebla, Mexico, November 26 - December 4, 2011, Proceedings.* Berlin Heidelberg: Springer.

Fabian, A., Barman, U., Bandyopadhyay, S. & Gelbukh, A. (2011b).Semantic Model for improving the Perfromance of Natural Language Interface to Database. In Batyrshin, I. & Sidorov, G. (Eds.). *Advances in Artificial Intelligence: 10th Mexican International Conference on Artificial Intelligence, MICAI 2011, Puebla, Mexico, November 26 - December 4, 2011, Proceedings.* Berlin Heidelberg*:* Springer.

Facione, A. (1990a). The California Critical Thinking Skills Test - College Level. Technical Report #1 - Experimental Validation and Content Validity. *The California Academic Press*. Washington, D.C.: ERIC.

Facione, A. (1990b). Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction. *The California Academic Press.* Millbrae, CA.

Facione, A. (2000). The disposition toward critical thinking: Its character measurement, and relation to critical thinking skill. *Informal Logic, 20*(1), 61–84.

Fann, T. (2013). *Symposium on J. L. Austin (Routledge Revivals).* Taylor & Francis.

Felix, U. (2003). *Language Learning Online: Towards Best Practice.* Taylor & Francis.

Felton, M. & Kuhn, D. (2001). The development of argumentive discourse skills. *Discourse Processes*, 32, 135-153.

Felton, M., Garciamila, M., VIllarroel, C. & Gilabert, S. (2015). Arguing collaboratively: Argumentative discourse types and their potential for knowledge building. *British Journal of Educational Psychology*, 85, 372-386.

Fernyhough, C. (2008). Getting Vygotskian about theory of mind: mediation, dialogue, and the development of social understanding. *Developmental review.* 28 (2). pp.225-262.

Fetzer, A. & Meierkord, C. (2002). *Rethinking Sequentiality: Linguistics Meets Conversational Interaction.* John Benjamins Publishing Company.

Fielding, G., Lee, M. & Lee, P. (1998). *Computer Analysis and Qualitative Research.* Sage Publications (CA).

Fischer, F. & Gottweis, H. (2012). *The Argumentative Turn Revisited: Public Policy as Communicative Practice.* Duke University Press.

Fischer, H. (2005). *Developing Standards in Research on Science Education: The ESERA Summer School 2004.* Taylor & Francis.

Fisher, A. (2001). *Critical Thinking: An Introduction. Cambridge.* Cambridge University Press.

Fitze, M. (2006). Discourse and Participation in ESL face-to-face and written electronic conferences. *Language Learning & Technology,* 10(1), 67-86.

Fitzpatrick, J. & Kazer, M. (2011). *Encyclopedia of Nursing Research*. (3rd Edition). Springer Publishing Company.

Flick, U. (2007). *Designing Qualitative Research*. SAGE Publications.

Flor, M. & Juan, U. (2010). Paragmatics and speech act performance. In Flor, M. & Juan, U. (Eds.). *Speech Act Performance: Theoretical, Empirical and Methodological Issues*. John Benjamins Pub. Company.

Forshaw, M. (2012). *Critical Thinking For Psychology: A Student Guide*. Wiley.

Fortune, E., Reid, J. & Miller, L. (2013). *Qualitative Research in Social Work.* Columbia University Press.

Foster, E. (2007). Enhancing Human- Computer Interaction with Embodied Conversational Agents. In *Proceedings of HCI International 2007. Universal Access in Human - Computer Interaction,* 4555:828–837.

Fox, H. (1994). *Listening to the world: Cultural issues in academic writing*. Urbana, IL: National Council of Teachers of English.

Fox, W. & Bayat, S. (2008). *A Guide to Managing Research*. Juta Academic.

Franck, D. (1985). Sentences In Conversational Turns. In Dascal, M. & Cuyckens, H. (Eds.). *Dialogue: An Interdisciplinary Approach.* John Benjamins Publishing Company.

Frawley, W. (2013). *Linguistic Semantics*. Taylor & Francis.

Frederking, E. (2012). *Integrated Natural Language Dialogue: A Computational Model*. Springer US.

Freed, A. & Ehrlich, S. (2009). *Why Do You Ask? The Function of Questions in Institutional Discourse.* Oxford University Press.

Freeley, J. & Steinberg, L. (2009). *Argumentation and Debate: Critical Thinking for Reasoned Decision Making.* Wadsworth/Cengage Learning.

Freeman, B. (2011). *Argument Structure: Representation and Theory*. Springer Netherlands.

Freund, L. & Cellary, W. (2014). *Advances in The Human Side of Service Engineering.* Independent Publisher.

Frey, A., Calvary, G., Chessa, S. & Mandran, N. (2013). Model-Based Self-Explanatory UIS for Free, But Are They Valuable. In Kotze, P., Marsden, G., Lindgaard, G., Wesson, J. & Winckler, M. (Eds.). *Human-Computer Interaction -- INTERACT 2013: 14th IFIP TC 13 International Conference, Cape Town, South Africa, September 2-6, 2013, Proceedings.* Berlin Heidelberg: Springer.

Friedenberg, J. (2010). *Artificial Psychology: The Quest for What It Means to Be Human*. Taylor & Francis.

Fryer, L. & Carpenter, R. (2006). Emerging technologies: BOTS as language learning tools. *Language Learning & Technology*, 10(3), 8-14.

Fuller, G. (2010). *Distinctive Distance Education Design: Models for Differentiated Instruction: Models for Differentiated Instruction.* Information Science Reference.

Fung, G. & Yuen, A. (2005). Student Adoption Towards Web-Based Learning Platform. In Lau, H. (Eds.). *Advances in Web-Based Learning - ICWL 2005: 4th International Conference, Hong Kong, China, July 31 - August 3, 2005, Proceedings*. Berlin Heidelberg: Springer.

Furst, J. (1981). Bloom's taxonomy of educational objectives for the cognitive domain: philosophical and educational issues. *Review of Educational Research*, 51 (5), 441-54.

Gagnon, W. & Collay, M. (2001). *Designing for Learning: Six Elements in Constructivist Classrooms.* SAGE Publications.

Galitz, O. (2007). *The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques*. Wiley.

Gambrill, E. (2012). *Propaganda in the Helping Professions*. Oxford University Press.

Garcia, C. (2013). *An Introduction to Interaction: Understanding Talk in Formal and Informal Settings*. Bloomsbury Publishing.

Gardner. H. (1993). *Frames of Mind: The theory of multiple intelligences*. New York: Basic Books

Gardner, H. (2006). *Multiple Intelligences: New Horizons*. Basic Books.

Garrison, R. (2011). *E-Learning in the 21st Century: A Framework for Research and Practice.* Taylor & Francis.

Garrison, R., Anderson, T. & Archer, W. (2000). Critical inquiry in a text-based environment: Computer conferencing in higher education. *Internet and Higher Education,* 2, 87-105

Garrison, R. & Anderson. T. (2003). *E-Learning in the 21st century: A framework for research and practice.* London: Routledge/Falmer.

Garton, F. (2008). *Exploring Cognitive Development: The Child As Problem Solver*. Wiley.

Gasperis, D., Chiari I. & Florio, N. (2012). AIML Knowledge Base Construction from Text Corpora. In Yang, S. (Eds.). A*rtificial Intelligence, Evolutionary Computing and Metaheuristics: In the Footsteps of Alan Turing*. Berlin Heidelberg: Springer.

Gauvain, M. (2001). *The Social Context of Cognitive Development*. Guilford Press.

Gay, G. & Hembrooke, H. (2004). *Activity-Centered Design: An Ecological Approach to Designing Smart Tools and Usable Systems.* MIT Press.

Geis, L. (2006). *Speech Acts and Conversational Interaction*. Cambridge University Press.

Gelbukh, A. (2012). *Computational Linguistics and Intelligent Text Processing: 13th International Conference, CICLing 2012, New Delhi, India Proceedings*. Springer.

Gemrot, J., Brown, C., Bryson, J. & Bida, M. (2012). Dialog Design In Virtual Drama: Balancing Agency and Scripted Dialogs. In Beer, M., Brom, C., Dignum, F. & Soo, W. (Eds.). *Agents for Educational Games and Simulations: International Workshop, AEGS 2011, Taipei, Taiwan, May 2, 2011, Revised Papers.* Berlin Heidelberg: Springer.

Gero, S. (2014). *Design Computing and Cognition '12*. Springer Netherlands.

Ghaoui, C. (2005). *Encyclopedia of Human Computer Interaction*. Idea Group Reference.

Ghigi, F., Hinarejos, C. & Benedi, J. (2014). Active Learinng to Speed-Up the Training Process for Dialogue Acts Labeling. In Vetulani, Z. & Mariani, J. (Eds.). *Human Language Technology Challenges for Computer Science and Linguistics: 5th Language and Technology Conference, LTC 2011, Poznań, Poland, November 25--27, 2011, Revised Selected Papers.* Springer International Publishing.

Ghosh, M. (2008). *Performatives, Knowledge and Truth.* Northern Book Centre.

Giachin, E. & McGlashan, S. (2013). Spoken Language Dialogue System. In Young, S. & Bloothooft, G. (Eds.). *Corpus-Based Methods in Language and Speech Processing.* Springer Netherlands.

Gibbon, D., Moore, R. & Winski, R. (1998). *Spoken Language System and Corpus Design.* De Gruyter.

Gibbons, P. (2002). *Scaffolding Language, Scaffolding Learning: Teaching Second Language Learners in the Mainstream Classroom*. Heinemann.

Gibbons, P. (2006). *Bridging Discourses in the ESL Classroom: Students, Teachers and Researchers.* Bloomsbury Academic.

Gibson, D. (2009). *Digital Simulations for Improving Education: Learning Through Artificial Teaching Environments: Learning Through Artificial Teaching Environments.* Information Science Reference.

Gibson, G. (1995). Critical thinking: implications for instruction. *Reference & User Services Quarterly (RQ)*, 35, 27–35.

Gibson, W. (2014). Sequential order in multimodal online educational discourse. *Discourse and Communication*, 8 (1). ISSN 1750-4813.

Gilbert, A., Grasso, F., Groarke, L., Gurr, C. & Gerlofs, M. (2003). The Persuasion Machine. In Norman, T. J. & Reed, C. (Eds.). *Argumentation machines: New frontiers in argument and computation*. Springer Netherlands.

Ginzburg, J. & Fernandez, R. (2013). Computational models of dialogue. In Clark, A., Fox, C. & Lappin, S. (Eds.). *The Handbook of Computational Linguistics and Natural Language Processing*. Wiley.

Girod, J. (2014). *Logical Investigative Methods: Critical Thinking and Reasoning for Successful Investigation.* CRC Press.

Given, M. (2008). *The SAGE Encyclopedia of Qualitative Research Methods*. SAGE Publications.

Go, K. & Carroll, J. (2003). Scenario-Based Task Analysis. In Diaper, D. & Stanton, N. (Eds.). *The Handbook of Task Analysis for Human-Computer Interaction*. CRC Press

Godden, M. & Walton. D. (2004). Denying the antecedent as a legitimate argumentative strategy: A dialectical model. *Informal Logic*, 24(3):219–243.

Goddu, A. (2010). *Copernicus and the Aristotelian Tradition: Education, Reading, and Philosophy in Copernicus's Path to Heliocentrism.* Brill.

Godinho, S. & Wilson, J. (2013). *Helping Your Pupils to Ask Questions*. Taylor & Francis.

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The Qualitative Report*, 8, 597–601.

Goodman, F. (1993). *First Logic*. University Press of America.

Goodwyn, A. & Stables, A. (2004). *Learning to Read Critically in Language and Literacy*. SAGE Publications.

Goodyear, P. (2000). Effective networked learning in higher education: notes and guidelines. *(JISC/CALT), Lancaster University.*

Gordon, P. (2014). *A Guide to Educational Research.* Taylor & Francis.

Gorecky, D., Lawson, G., Mura, K., Hermawati, S. & Overby, M. (2012). User-Centred Design of a Game-based, Virtual Training System. In Trzcielinski, S. & Karwowski, W. (Eds.). *Advances in Ergonomics in Manufacturing.* CRC Press.

Gould, D. & Lewis, C. (1985). Designing for usability: Key principles and what designers think. *Communications of the ACM, 28*(3), 300–311.

Goulding, C. (2002). *Grounded Theory: A Practical Guide for Management, Business and Market Researchers*. SAGE Publications.

Govier, T. (1987). *Problems in Argument Analysis and Evaluation*. Foris Publications.

Govier, T. (2009). *A Practical Study of Argument*. Cengage Learning.

Grant, J. Franklin, P. & Langford, J. (2002). The self-reflection and insight scale: A new measure of private self-consciousness. *Social Behavior and Personality*, 30 (2002), pp.821–836.

Grasser, A. (2015). Authoring Conversation-based Tutors. In Sottilare, R., Graesser, A., Hu, X. & Brawner, K. (Eds.). *Design Recommendations for Intelligent Tutoring Systems: Authoring Tools and Expert Modeling Techniques*. Army Research Laboratory.

Gravano, A., Hirschberg, J. & Benus, S. (2012). Affirmative cue words in task-oriented dialogue. *Computational Linguistics,* 38 (1): 1–39.

Gray, E. (2013). *Doing Research in the Real World.* SAGE Publications.

Grayling, C. (2010). *Thinking of Answers: Questions in the Philosophy of Everyday Life*. Bloomsbury Publishing.

Greenwood, A., Corrallo, S. & Statistics, E. (1994). The National Assessment of College Student Learning: Identification of the Skills to be Taught, Learned, and Assessed. *A Report on the Proceedings of the Second Study Design Workshop, November 1992, National Center for Education Statistics, U.S. Department of Education, Office of Educational Research and Improvement.*

Greiffenstern, S. (2010). *The Influence of Computers, the Internet and Computer-Mediated Communication on Everyday English*. Isd.

Grewendorf, G. & Meggle, G. (2012). *Speech Acts, Mind, and Social Reality: Discussions with John R. Searle*. Springer Netherlands.

Grice, P. (1975). Logic and conversation. In Cole, P. and Morgan, J. (Eds.). *Studies in Syntax and Semantics III: Speech Acts*. New York: Academic Press.

Grigoriadou, M., Tsaganou, G. & Cavoura, T. (2003). Dialogue-Based Reflective System for Historical Text Comprehension. *In Proceedings of Workshop on Learner Modelling for Reflection at Artificial Intelligence in Education*, pp.234-247.

Griol, D., Molina, J. & Miguel, A. (2014). Domain and Subtask-Adaptive Conversational Agent to Provide an Enhanced Human-Agent Interaction. In Demazeau, Y., Zambonelli, F., Corchado, M. & Pérez, B. (Eds.). *Advances in Practical Applications of Heterogeneous Multi-Agent Systems - The PAAMS Collection: 12th International Conference, PAAMS 2014, Salamanca, Spain, June 4-6, 2014. Proceedings.* Springer International Publishing.

Griol, D., Particio, M. & Molina, J. (2015). The CALIMACO Multimodal System: Providing Enhanced Library Services Using Mobile Device. In Vicente, F., Álvarez-Sánchez, R., De lópez, F., Toledo-Moreo, J. & Adeli, H. (Eds.). *Bioinspired Computation in Artificial Systems: International Work-Conference on the Interplay Between Natural and Artificial Computation, IWINAC 2015, Elche, Spain, June 1-5, 2015, Proceedings*. Springer International Publishing.

Grishman, R. (1986). *Computational Linguistics: An Introduction*. Cambridge University Press.

Gruber, C. (2014). *I'm Sorry for What I've Done: The Language of Courtroom Apologies.* Oxford University Press.

Gruyter, D. (1987). *Perspectives and Approaches.* De Gruyter

Guest, G., Macqueen, M. & Namey, E. (2011). *Applied Thematic Analysis.* SAGE Publications.

Guida, G. & Tesso, C. (2014). Online Information retrieval through natural language. In Johannsen, G. & Rijnsdorp, E. (Eds.). *Analysis, Design and Evaluation of Man – Machine Systems: Proceedings of the IFAC/IFIP/IFORS/IEA Conference, Baden-Baden, Federal Republic of Germany, 27-29 September 1982.* Elsevier Science.

Guion, L. (2001). Triangulation: Establishing the Validity of Qualitative Studies1. *Institute of Food and Agriculure Sciences.* Florida, USA.

Guldberg, K. & Pilkington, R. (2007). Tutor roles in Facilitating Reflection on Practice Through Online Discussion. *Educational Technology & Society*, 10 (1), 61-72.

Gulz. A., Haake, M. & Silvervarg, A. (2011). Building a Social Conversational Pedagogical Agent. In Perez-Marin, D. (Eds.). *Conversational Agents and Natural Language Interaction: Techniques and Effective Practices: Techniques and Effective Practices.* Information Science Reference.

Guo, X. & Zhang, N. (2011). User Attitude Towards Mandatory Use of information Systems: A Chinese Cultural Perspective. In Tan, B. (Eds.). *International Comparisons of Information Communication Technologies: Advancing Applications: Advancing Applications*. Information Science Reference.

Guyote, M. & Sternberg, J. (1981). A transitive-chain theory of syllogistic reasoning. *Cognitive Psychology,* 13, 461–525.

Haake, M. & Gulz, A. (2009). A look at the roles of look & roles in embodied pedagogical agents—a user preference perspective. *International Journal of Artificial Intelligence in Education,* 19 (1), 39–71.

Habernal, I., Konopik, M. & Rohlik, O, (2012). Question Answering. In Jouis, C. (Eds.). *Next Generation Search Engines: Advanced Models for Information Retrieval: Advanced Models for Information Retrieval*. Information Science Reference.

Hackett, P. (2015). *Qualitative Research Methods in Consumer Psychology: Ethnography and Culture.* Taylor & Francis.

Hagen, P. & Jordan, P. (2011). Theoretical Foundation of Academic Advising. In Gordon, N., Habley, R. & Grites, J. (Eds.). *Academic Advising: A Comprehensive Handbook*. Wiley.

Hagethorn, F., Krose, B., Greel, P. & Hemler, M. (2008). Creating Design Guidelines for a Navigational Aid for Mild Demented Pedestrians. In Aarts, L., Crowley, L., Gerhäuser, H., Pflaum, A., Schmidt, J. & Wichert, R. (Eds.). *Ambient Intelligence: European Conference, AmI 2008, Nuremberg, Germany, November 19-22, 2008. Proceedings*. Berlin Heidelberg: Springer.

Haideri, F. (2005). *Design of Machine Elements*. Nirali Prakashan.

Hajdinjak, M. & Mihelic, F. (2004). Information-Providing Dialogue Management. In Sojka, P., Kopecek, I. & Pala, K. (Eds.). *Text, Speech and Dialogue: 7th International Conference, TSD 2004, Brno, Czech Republic, September 8-11, 2004, Proceedings.* Berlin Heidelberg: Springer.

Hala, S. (2013). *The Development of Social Cognition*. Taylor & Francis.

Halonen, S. (1995). Demystifying critical thinking. *Teaching of Psychology, 22,* 75–81.

Halonen, S. & Gray, C. (2001). *The Critical Thinking Companion for Introductory Psychology*. Worth Publishers.

Halpern, F. (2003). *Thought and Knowledge: An Introduction to Critical Thinking*, (4th edition). Lawrence Erlbaum Associates, Publishers.

Halpern, F. (2007). The Nurture of Critical Thinking. In Sternberg, J., Roediger, L. & Halpern, F. (Eds.). *Critical Thinking in Psychology.* Cambridge University Press.

Halpern, F. (2013). *Thought and Knowledge: An Introduction to Critical Thinking.* Taylor & Francis.

Halpern, F. (2014). *Critical Thinking Across the Curriculum: A Brief Edition of Thought & Knowledge*. Taylor & Francis.

Halpern, F., Sternberg, R. .(Roediger, H. (2006 &*Critical Thinking in Psychology*. (1st edition). Cambridge University Press.

Hammersley, M. (2013). *What is Qualitative Research?* Bloomsbury Academic.

Hample, D. (2006). *Arguing: Exchanging Reasons Face to Face.* Taylor & Francis.

Hampel, R., & Hauck, M. (2004) Towards an effective use of audio conferencing in distance language courses. *Language Learning & Technology*, 8(1), 66–82.

Hanhijärvi, J. (2015). *Dialectical Thinking: Zeno, Socrates, Kant, Marx.* Algora Publishing.

Hannum, H. (2001). Web-Based Training: Advantages and Limitations. In Khan, B. (Eds.). *Web-Based Training*. Englewood Cliffs, NJ: Educational Technology Publications.

Harasim, L. (2012). *Learning Theory and Online Technologies.* Taylor & Francis.

Harman, G. (2002) Logic and the Practical Turn. In Johnson, H., Ohlbach, J., Gabbay, M. & Woods, J. (Eds.). *Handbook of the Logic of Argument and Inference: The Turn Towards the Practical.* Elsevier Science.

Harris, B. (2014). *Creating a Classroom Culture That Supports the Common Core: Teaching Questioning, Conversation Techniques, and Other Essential Skills*. Taylor & Francis.

Hartley, R. (1998). Qualitative reasoning and conceptual change: computer based support in understanding science. In Winkels, F. & Bredeweg, B. (Eds.), *Interactive Learning Environments. Special Issue on The Use of Qualitative Reasoning Techniques in Interactive Learning Environments*, 5, 53-64.

Harwell, R. (2011). Research Design in Qualitative/Quantitative/MixedMethods. In Conrad, F. & Serlin, C. (2011). *The SAGE Handbook for Research in Education: Pursuing Ideas as the Keystone of Exemplary Inquiry*. SAGE Publications.

Hasibi, F. (2012). An Adaptation Technique for GF-Based Dialogue Systems. In Kuhn, T. & Fuchs, E. (Eds.). *Controlled Natural Language: Third International Workshop, CNL 2012, Zurich, Switzerland, August 29-31, 2012, Proceedings.* Berlin Heidelberg: Springer.

Hastie, H. (2012). Metrics and Evaluation of Spoken Dialogue System. In Lemon, O. & Pietquin, O. (Eds.). *Data-Driven Methods for Adaptive Spoken Dialogue Systems: Computational Learning for Conversational Interfaces.* New York: Springer.

Hatch, E. (1992). *Discourse and Language Education.* Cambridge University Press.

Hatch, A. (2010). *Doing Qualitative Research in Education Settings*. State University of New York Press.

Hayashi, R. (1996). *Cognition, Empathy, and Interaction: Floor Management of English and Japanese Conversation.* Ablex Pub.

Hays, G. & Singh, A. (2012). *Qualitative Inquiry in Clinical and Educational Settings*. Guilford Press.

Heafner, L. (2014). *Exploring the Effectiveness of Online Education in K-12 Environments.* IGI Global.

Hedley, N., Antonacci, P. & Rabinowitz, M. (2013). *Thinking and Literacy: The Mind at Work*. Taylor & Francis.

Heigham, J. & Croker, R. (2009). *Qualitative Research in Applied Linguistics: A Practical Introduction.* Palgrave Macmillan UK.

Heinroth, T. & Minker, W. (2012). *Introducing Spoken Dialogue Systems into Intelligent Environments.* New York: Springer.

Heller, B., Proctor, M., Mah, D., Jewell, L. & Cheung, B. (2005). Freudbot: An Investigation of Chatbot Technology in Distance Education. In *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications*, pp.3913-3918.

Helsper, E. & Eynon, R. (2009). Digital natives: where is the evidence? *British educational research journal.* pp.1-18, 36(3), 503–520.

Henkemans, S. (1997). *Analysing Complex Argumentation: The Reconstruction of Multiple and Coordinatively Compound Argumentation in a Critical Discussion*. SICSAT.

Hennink, M., Hutter, I. & Bailey, A. (2010). *Qualitative Research Methods.* SAGE Publications.

Hepner, M. (2015). The Erosion of Critical Thinking Development in Post-Secondary Education: The need to Return to Liberal Education. In Wisdom, S. (Eds.). *Handbook of Research on Advancing Critical Thinking in Higher Education*. IGI Global.

Heritage, J. (2005). Conversation analysis and institutional talk. In Fitch, K. & Sanders, L (Eds.). *Handbook of language and social interaction.* Taylor & Francis.

Hernon, P., Dugan, E. & Schwartz, C. (2013). *Higher Education Outcomes Assessment for the Twenty-First Century*. ABC-CLIO.

Herring, S. (1999). Interactional Coherence in CMC. *Journal of Computer-Mediated Communication*, 4(4).

Heydenberk, W. & Heydenberk, R. (2000). *A Powerful Peace: The Integrative Thinking Classroom*. Pearson/Allyn and Bacon Publishers.

Higashinaka, K., Imamura, T., Meguro, C., Miyazaki, N., Kobayashi, H., Sugiyama, T., Hirano, T., Makino, Y. (2014). Towards an open domain conversational system fully based on natural language processing. 2014. In *Proceedings of the 25th International Conference on Computational Linguistics (COLING 2014): Technical Papers, Dublin, Ireland*.

Hillocks, G. (2010). Teaching argument for critical thinking and writing: An introduction. *English Journal*, *99* (6), 24- 32. [Online] Available at http://www.ncte.org/library/nctefiles/ej0996focus.pdf. [Accessed 25/06/2016].

Hobbs, J. (2002). From Question-Answering to Information-seeking Dialogs. *Artificial Intelligence Center SRI International Menlo Park*, California.

Hoidn, S. (2016). *Student-Centered Learning Environments in Higher Education Classrooms*. Palgrave Macmillan US.

Hollihan, A. & Baaske, T. (2004). *Arguments and Arguing: The Products and Process of Human Decision Making.* (2nd edition). Waveland Press.

Holloway, I. (2005). *Qualitative Research In Health Care.* Open University Press.

Holloway, I. & Brown, L. (2012). *Essentials of a Qualitative Doctorate.* Left Coast Press.

Holloway, I. & Wheeler, S. (2013). *Qualitative Research in Nursing and Healthcare*. Wiley.

Holtgraves, M. (2013). *Language As Social Action: Social Psychology and Language Use*. Taylor & Francis.

Hong, H. & Cho, B. (2003). A Two Stage Bayesian Network for Effective Development of Conversational Agent. In Liu, J., Cheung, Y. & Yin, H. (Eds.). *Intelligent Data Engineering and Automated Learning: 4th International Conference, Ideal 2003, Hong Kong, China, March 21-23, 2003: Revised Papers*. Berlin Heidelberg: Springer.

Hook, D., Watts, J. & Cockcroft, K. (2002). D*evelopmental Psychology.* University of Cape Town Press.

Hopkins, R. (2013). *Empowering Education.* John Hunt Publishing Limited.

Hoppenbrouwers, S., Thijssen, S. & Vogels, J. (2013).Operationalizing Dialogue Games for Collaborative Modeling. In Nolte, A., Prilla, M., Rittgen, P. & Oppl, S. In *Proceedings of the International Workshop on Models and their Role in Collaboration at the ECSCW 2013 (MoRoCo 2013).*

Hopper. H. (2011). *Practicing College Learning Strategie.* Cengage Learning.

Houser, A. (2014). *Counseling and Educational Research: Evaluation and Application*. SAGE Publications.

Houser, J. (2013). *Nursing Research: Reading, Using and Creating Evidence*. Jones & Bartlett Learning, LLC.

Howard, J. (2015). *Research Methods: A Handbook for Beginners.* Outskirts Press.

Hu, X., Morrison, D., & Cia, Z. (2013). On the Use of Learner Micromodels as Partial Solutions to Complex Problems in a Multiagent, Conversation-Based Intelligent Tutoring System. In Robert A., Sottilare, L., Graesser, A., Xiangen, M. & Holden, U. (Eds.). *Design Recommendations for Intelligent Tutoring Systems: Volume 1 - Learner Modeling*, U.S. Army Research Laboratory.

Huang, J., Zhou, M. & Yang. D. (2007). Extracting chatbot knowledge from online discussion forums. In *Proceedings of the 20th International Joint Conference on Artificial Intelligence (IJCAI),* pp 423–428.

Huang, S. (2010). *Academic Communication Skills: Conversation Strategies for International Graduate Students*. UPA.

Hudson, P. (2013). *Learning to Teach in the Primary School.* Cambridge University Press.

Hughes, H. & Lavery, A. (2008). *Critical Thinking*. (5th Edition). Broadview Press.

Hung, V., Elvir, M., Gonzalez, A. & DeMara, R. (2009). Towards a method for evaluating naturalness in conversational dialog systems. In *Proceedings of the 2009 IEEE International Conference on Systems, Man, and Cybernetics San Antonio, TX, USA*, 1236–1241.

Hunter, A. (2014). *A Practical Guide to Critical Thinking: Deciding What to Do and Believe.* Wiley.

Huse, N. & Le, N. (2016). The Formal Model for the Socratic Method. In Nguyen, B., Van, T., Thi, L. & Nguyen, T. (Eds.). *Advanced Computational Methods for Knowledge Engineering:*

Proceedings of the 4th International Conference on Computer Science, Applied Mathematics and Applications, ICCSAMA 2016, 2-3 May, 2016, Vienna, Austria. Springer International Publishing.

Hussein, N. (2006). Behaviorism And Mentalism And Language Learning. *College of Basic Education. Diala University.*

Imran, A. & Kowalski, J. (2014). HIP-A Technology-Rich and Interactive Multimedia Pedagogical Platform. In Zaphiris, P. & Ioannou, A. (Eds.). *Learning and Collaboration Technologies: Designing and Developing Novel Learning Experiences: First International Conference, LCT 2014, Held as Part of HCI International 2014, Heraklion, Crete, Greece, June 22-27, 2014, Proceedings*. Springer International Publishing.

Inoue, Y. (2007). *Online Education for Lifelong Learning.* Information Science Pub.

Isaias, P. & Issa, T. (2014). *High Level Models and Methodologies for Information Systems*. New York: Springer

Iskander, M. (2007). *Innovations in E-learning, Instruction Technology, Assessment and Engineering Education.* Springer Netherlands.

Ivala, E. (2013). *ICEL2013-Proceedings of the 8th International Conference on e-Learning: ICEL 2013.* Academic Conferences and Publishing Limited.

Jacko, A. & Stephanidis, C. (2003). *Human-Computer Interaction: Theory and Practice*. Taylor & Francis.

Jackson, L., Krajcik, J. & Soloway, E. (1998). The design of learner-adaptable scaffolding in interactive learning environments. *Human Factors in Computing Systems: CHI 98* pp.197-194. ACM Press.

Jackson, S. & Jacobs, S. (1992).Structure of Conversational Argument: Pragmatic Bases for the Enthymeme (Enthymeme: Argument with stating clearly Premises). In Benoit, L., Hample, D. & Benoit, J. (Eds.). *Readings in Argumentation*. Foris Publications.

Jacobs, S. (1989). Speech acts and arguments. *Argumentation*, 3, 345-365.

Jekat, S., Klein, A., Maier, E., Maleck, I., Mast, M. & Quantz, J. (1995). *Dialogue Acts in VERBMOBIL verbmobil*- Report–65–95.

Jenlink, M. & Banathy, H. (2007). *Dialogue as a Collective Means of Design Conversation*. Springer US.

Jenks, J. (2014). *Social Interaction in Second Language Chat Rooms.* Edinburgh University Press.

Jennex, M. & Olfman, L. (2013). Organizational Memory. In Holsapple, C. (Eds.). *Handbook on Knowledge Management 1: Knowledge Matters.* Berlin Heidelberg: Springer.

Jia, J. (2004). The study of the application of a web-based chatbot system on the teaching of foreign languages. In *Proceedings of the SITE2004 (The 15the annual conference of the Society for Information Technology and Teacher Education). AACE press, USA*, pp.1201–1207

Jia, J. (2014). *Intelligent Web-Based English Instruction in Middle Schools*. Igi Global.

Jia, J. & Chen, W. (2008). Motivate the Learner to practice English through Playing with Chatbot CSIEC. In Pan, Z., Zhang, X., Rhalibi, E., Woo, W. & Li, Y. (Eds.). *Technologies for E-Learning* *and Digital Entertainment: Third International Conference, Edutainment 2008, Nanjing, China, June 25-27, 2008, Proceedings.* Springer.

Johnson, B. & Christensen, L. (2010). *Educational Research: Quantitative, Qualitative, and Mixed Approaches.* SAGE Publications.

Johnson, B. & Christensen, L. (2013). *Educational Research: Quantitative, Qualitative, and Mixed Approaches.* SAGE Publications.

Johnson, G. (2015). *Research Methods for Public Administrators*. Taylor & Francis Group.

Johnson, N. (2008). Postcards From The (Turbulent) Edge (of Chaos): Complexity Theory and Computer Mediated Communication. In Magnan, S. (Eds.). *Mediating Discourse Online*. John Benjamins Pub

Johnson, R. (2012). Informal Logic & its contribution to argumentation theory. In Ribeiro, J. (Eds.). *Inside Arguments: Logic and the Study of Argumentation*. Cambridge Scholars Publisher.

Johnson, R. (2014). *The rise of informal logic: Essays on argumentation, critical thinking, reasoning and politics.* V. 2. University of Windsor.

Johnston, B., Ford, P., Mitchell, R., Myles, F. & Haynes, A. (2011). *Developing Student Criticality in Higher Education: Undergraduate Learning in the Arts and Social Sciences*. Bloomsbury Publishing.

Johnston, J., Killion, J., & Oomen, J. (2005). Student satisfaction in the Virtual Classroom. *The Internet Journal of Allied Health Sciences and Practice*, 3(2).

Jokinen, K. (2009). *Constructive Dialogue Modelling: Speech Interaction and Rational Agents*. Wiley.

Jokinen, K. (2010). Spoken Language Dialogue Models. In Chen, F. & Jokinen, K. (Eds.). *Speech Technology: Theory and Applications*. Springer US.

Jokinen, K. & McTear, M. (2010). *Spoken Dialogue Systems*. Morgan & Claypool Publishers.

Jolley, J. (2013). *Introducing Research and Evidence-Based Practice for Nursing and Healthcare Professionals*. Taylor & Francis.

Jonassen D., Davidson, M., Collins, M., Campbell, J., & Bannan, B. (1995). Constructivism and Computer-Mediated Communication in Distance Education. *The American Journal of Distance Education*, 9 (2).

Jones, C. & Shao, B. (2011). *The net generation and digital natives: Implications for higher education.* York: Higher Education Academy. [Online] Available at: http://oro.open.ac.uk/30014/. [Accessed 19/05/2016].

Jones, D. (1998). *Exploring the Internet Using Critical Thinking Skills: A Self-paced Workbook for Learning to Effectively Use the Internet and Evaluate Online Information*. Neal-Schuman.

Jones, R., Torres, V. & Arminio, J. (2013). *Negotiating the Complexities of Qualitative Research in Higher Education: Fundamental Elements and Issues.* Taylor & Francis.

Jones-Devitt, S. & Smith, L. (2007). *Critical Thinking in Health and Social Care.* SAGE Publications.

Jordan, A., Carlile, O. & Stack, A. (2008). *Approaches To Learning: A Guide For Teachers: A Guide for Educators.* McGraw-Hill Education.

Josefa, Z., Serrano, A. & Calle, H. (2006). Dialoguing with an Online Assistant in a Financial Domain: The VIP-Advisor Approach. In *DEVED#IC, V. 2006. Artificial Intelligence Applications and Innovations: IFIP 18th World Computer Congress TC12 First International Conference on Artificial Intelligence Applications and Innovations (AIAI-2004) 22–27 August 2004 Toulouse, France.* Springer US.

Joshi, A. & Sarda, N. (2010). Evaluating Relative Contributions of Various HCI Activities to Usability. In Bernhaupt, R. (2010). *Human-Centred Software Engineering: Third International Conference, HCSE 2010, Reykjavik, Iceland, October 14-15, 2010. Proceedings.* Berlin Heidelberg: Springer.

Judge, B., McCreery, E. & Jones, P. (2009). *Critical Thinking Skills for Education Students*. SAGE Publications.

Jurado, V. (2015). A multimodal Approach to Persuasion in Conference Presentation. In Camiciottoli, C. & Fortanet-Gómez, I. (Eds.). *Multimodal Analysis in Academic Settings: From Research to Teaching*. Taylor & Francis.

Jurafsky, D., Bates, R., Coccaro, N., Martin, R., Meteer, M., Ries, K., Shriberg, E., Stolcke, A. & Taylor, P. (1997). Automatic detectionof discourse structure for speech recognition and understanding. *In Proceedings of the 1997 IEEE Workshop on Speech Recognition and Understanding, SantaBarbara,* pp.88–95.

Jurafsky, D. & Martin, H. (2009). *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition*. Pearson Prentice Hall.

Jürgen, H. (2006). *The Virtual Linguistics Campus*. Waxmann Verlag.

Juwah, C. (2006). *Interactions in Online Education: Implications for Theory and Practice.* Taylor & Francis.

Kachru, Y. & Smith, E. (2008). *Cultures, Contexts, and World Englishes.* Taylor & Francis.

Kadir, R. & Din, R. (2006). Computer mediated Communication: A Motivational Strategy towards Diverse Learning Style. *Jurnal pendidikan,* pp.31, 41-51

Kail, V. & Cavanaugh, C. (2015). *Human Development: A Life-Span View*. Cengage Learning.

Kane, D. (2016). The Role of Chatbots in Teaching and Learning. In Rice, S. & Gregor, N. (Eds.). *E-Learning and the Academic Library: Essays on Innovative Initiatives*. McFarland, Incorporated Publishers.

Kaplan, L. & Owings, W. (2014). *Educational Foundations*. Cengage Learning.

Kaplan, M., Silver, N., Lavaque-Manty, D. & Meizlish, D. (2013). *Using Reflection and Metacognition to Improve Student Learning: Across the Disciplines, Across the Academy*. Stylus.

Karat, C., Vego, J. & Nabamoo, D. (2002). Conversational Interface Technologies. In Sears, A. & Jacko, A. (Eds.). *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications.* (3rd edition). CRC Press.

Kaye, S. (1990). *Writing Under Pressure: The Quick Writing Process.* Oxford University Press.

Kear, K. (2011). *Online and Social Networking Communities: A Best Practice Guide for Educators.* Taylor & Francis.

Kear, K., Chetwynd, F. & Jefferis, H. (2014). Social presence in online learning communities: the role of personal profiles. *Research in Learning Technology*, 22(2014), 1–15.

Keeling, J., Chapman, M. & Williams, J. (2013). *How To Write Well: A Guide For Health And Social Care Students: A Guide for Health and Social Care Students.* Open University Press.

Keeton, T., Sheckley, G., Griggs, K. & Adult, F. (2002). *Effectiveness and Efficiency in Higher Education for Adults: A Guide for Fostering Learning.* Kendall/Hunt Pub.

Keith, W. & Rehg, W. (2008). Argumentation in Science: The Cross-Fertilization of Argumentation Theory and Science Studies. In Hackett, E. (Eds.). *The Handbook of Science and Technology Studies*. MIT Press.

Keizer, S., Rossignol, S., Chandramohan, S. & Pietquin, O. (2012). User Simulation in the Development of Statistical Spoken Dialogue System. In Lemon, O. & Pietquin, O. (Eds.). *Data-Driven Methods for Adaptive Spoken Dialogue Systems: Computational Learning for Conversational Interfaces*. New York: Springer.

Kelsey, S. & Amant, S. (2012). *Computer Mediated Communication: Issues and Approaches in Education.* Information Science Reference.

Kerfoot P., Baker, H., Thomas, L., William, J., Daniel, D., Federman, R., Oates, D. & De Wolf, W. (2006). Multi-institutional randomized controlled trial of web-based teaching to medical students. *Academic Medicine. Volume 81. No. 3,* pp.224–30.

Kerly, A. & Bull, S. (2006). The Potential for Chatbots in Negotiated Learner Modelling: A Wizard-of-Oz Study. In Ikeda, M. & Ashley, T. & Chan, W (Eds.). *Intelligent Tutoring Systems: 8th International Conference, Springer-Verlag, Berlin Heidelberg,* pp.443-452.

Kerly, A., Ellis, R. & Bull, S. (2008). CALMsystem: A Conversational Agent for Learner Modelling. *Knowledge Based Systems, 2008.* 21(3): p.238-246.

Kerly, A., Ellis, R. & Bull, S. (2010). Conversational Agents in E-Learning. In Allen, T., Ellis, R. & Petridis, M. (Eds.). *Applications and Innovations in Intelligent Systems XVI: Proceedings of AI-2008, The Twenty-eighth SGAI International Conference on Innovative Techniques and Applications of Artificial Intelligence*. London: Springer.

Kerly, A., Hall, P. & Bull, S. (2006). Bringing Chatbots into Education: Towards Natural Language Negotiation of Open Learner Models. In Ellis, R., Allen, D. & Tuson, A. (Eds.). *Applications and Innovations in Intelligent Systems XIV – Proceedings of AI-2006, 26th SGAI International Conference on Innovative Techniques and Applications of Artificial Intelligence*. Springer.

Kervin, L. (2006). *Research for Educators.* Thomson Social Science Press.

Khan, A. (2011).*Research Methodology.* APH Publishing Corporation.

Khan, B. (1997). Web-based instruction: What is it and why is it? In Khan, H. (Eds.). *Web-based instruction* (pp.5-18). Englewood Cliffs, NJ: Educational Technology Publications

Khan, S. (2008). *Educational Research*. APH Publishing Corporation.

Khine, S. & Fisher, L. (2003). *Technology-rich Learning Environments: A Future Perspective*. World Scientific.

Killen, R. (2006). *Effective Teaching Strategies: Lessons from Research and Practice.* Thomson Social Science Press.

Kim, G., Lee, H. & Han, G. (2002). Educational Application of Dialogue System to Support e-Learning. In *Association for the Advancement of Computing in Education*. AACE.

Kim, H. (2007). *Usability and Effectiveness Evaluation of a Course-advising Chat Bot*. State University of New York at Buffalo.

Kim, T. (2010). Emerging Approach of Natural Language Processing in Opinion Mining: A Review. In Omar, S. (Eds.). *Ubiquitous Computing and Multimedia Applications: International Conference, UCMA 2010, Miyazaki, Japan, June 23-25, 2010. Proceedings*. Berlin Heidelberg: Springer.

King, N. & Horrocks, C. (2010). *Interviews in Qualitative Research.* SAGE Publications.

King, P & Kitchener, K. (1994). *Developing ReflectiveJudgment.* San Francisco: Jossey-Bass Publishers.

Kiraly, D. (2001). Towards a constructivist approach to translator education. *Quaderns*. 6, 50-53.

Kissine, M. (2013). *From Utterances to Speech Acts.* Cambridge University Press.

Kitade, K. (2012). An exchange structure analysis of the development of online intercultural activity. *Computer Assisted Language Learning*, 25:1, 65-86.

Kitchener, S. & Fischer, W. (1990). A Skill Approach to The Development Of Reflective Thinking. In Kuhn, D. (Eds.). *Contributions to human development: developmental perspectives on teaching and learning, Vol 21.* Basel, Switzerland: Karger.

Kitchener, S., Lynch, L., Fischer, W. & Wood, K. (1993). Developmental range of reflective judgment: The effect of contextual support and practice on developmental stage. *Developmental Psychology*, 29(5), 893-906.

Kluwer, T. (2011a). From Chatbot to Dialog System. In Perez-Marin, D. (Eds.). *Conversational Agents and Natural Language Interaction: Techniques and Effective Practices: Techniques and Effective Practices.* Information Science Reference.

Kluwer, T. (2011b). I like your Shirt-Dialogue acts for Enabling Social Talk in Conversational Agent. In Vilhjálmsson, H., Kopp, S., Marsella, S. & Thorisson, R. (Eds.). *Intelligent Virtual Agents: 11th International Conference, IVA 2011, Reykjavik, Iceland, September 15-17, 2011. Proceedings.* Berlin Heidelberg: Springer.

Kneser, C., Pilkington, R. & Treasure-Jones, T. (2001).The tutor's role: an investigation of the power of exchange structure analysis to identify different roles in CMC seminars. *Journal of Artificial Intelligence in Education* 12, 63–84.

Knill, O., Carlsson J., Chi, A. & Lezama, M. (2004). An artifical intelligence experiment in college math education. [Online]. Available at: http://www.math.harvard.edu/~knill/preprints/sofia.pdf. [Accessed 20/07/2016].

Kobsa, A., Carberry, S., Wahlster, W., Carbonell, G., Chin, N., Cohen, R., Lehman, F., Finin, W., Jameson, A. & Jones, M. (2012). *User Models in Dialog Systems*. Berlin Heidelberg: Springer.

Koh, C. (2015). *Motivation, Leadership and Curriculum design: Engaging the Net Generation and 21st Century Learners.* Springer Singapore.

Kopp, B. & Mandl, H. (2012). Supporting Virtual Collaborative Learning using Collaboration Scripts and Content schemes. In Management Association. (Eds.). *Virtual Learning Environments: Concepts, Methodologies, Tools and Applications*. Information Science Reference.

Kotelly, B. (2003). *The Art and Business of Speech Recognition: Creating the Noble Voice.* Addison-Wesley.

Kozma, B., Belle, W. & Williams, W. (1978). *Instructional Techniques in Higher Education*. Educational Technology Publications.

Kramer, N., Putten, A. & Eimler, S. (2012). Human-Agent and Human-Robot Interaction Theory: Similarities to And Differences From Human-Human Interaction. In Zacarias, M. & De Oliveira, V. (Eds.). *Human-Computer Interaction: The Agency Perspective*. Berlin Heidelberg: Springer.

Krar, F. & Gill, A. (2003). *Exploring Advanced Manufacturing Technologies*. Industrial Press.

Kshirsagar, S., Egges A. & Garchery, S. (2005).Expressive Speech Animation and Facial Communication. In Magnenat-Thalmann, N. & Thalmann, D. (Eds.). *Handbook of Virtual Humans*. Wiley.

Kuhn, D. (1991). *The Skills of Argument*. Cambridge University Press.

Kuhn, D. (2009a). *Education for Thinking*. Harvard University Press.

Kuhn, D. (2009b). Do students need to be taught how to reason? *Educational Research Review,* 4(1), 1-6.

Kuhn, D., Hemberger, L. & Khait, V. (2015). *Argue With Me: Argument As a Path to Developing Students' Thinking and Writing*. Routledge.

Kuhn, D, Shaw, V. & Felton, M. (1997). Effects of Dyadic Interaction on Argumentative Reasoning. *Cognition and Instruction.* 15:3, 287-315.

Kuhn, D. & Udell, W. (2003). The development of argument skills. *Child Development,* 74, 1245 – 1260.

Kuhn, D. & Udell, W. (2007). Co-ordinating own and other perspectives in argument. *Thinking and Reasoning*, 13(2), 90 – 104.

Kuligowska, K. (2015). Commercial Chatbot: Performance Evaluation, Usability Metrics and Quality Standards of Embodied Conversational Agents. *Professionals Center for Business Research* (2015). [Online] Available at: SSRN: http://ssrn.com/abstract=2569637. [Accessed 11/07/2016].

Kumar, E. (2011). *Natural Language Processing*. International Publishing House.

Kumar, R. (2005). *Human Computer Interaction*. Laxmi Publications.

Kumar, R. (2014). *Research Methodology: A Step-by-Step Guide for Beginners*. SAGE Publications.

Kunert, T. (2009). *User-Centered Interaction Design Patterns for Interactive Digital Television Applications*. London: Springer.

Kurkovsky, S. (2009). *Multimodality in Mobile Computing and Mobile Devices: Methods for Adaptable Usability: Methods for Adaptable Usability.* Information Science Reference.

Kurosu, M. (2016). *Human-Computer Interaction. Theory, Design, Development and Practice: 18th International Conference, HCI International 2016, Toronto, ON, Canada, July 17-22, 2016. Proceedings.* Springer International Publishing.

Kvale, S. (1996). *InterViews: An Introduction to Qualitative Research Interviewing*. SAGE Publications.

Kvale, S. (2005). The dominance of dialogical interview research. *Impuls,* 1, 5-13.

Kyei-Blankson, L. (2013). *Practical Applications and Experiences in K-20 Blended Learning Environments.* IGI Global.

L'Abbae, M. & Thiel, U. (2003). *The use of contextual Information in a proactivity Model for Conversational agents*. In Blackburn, P., Ghidini, C., Turner, M. & Giunchiglia, F. (Eds.). *Modeling and Using Context: 4th International and Interdisciplinary Conference, CONTEXT 2003, Stanford, CA, USA, June 23-25, 2003, Proceedings*. Berlin Heidelberg: Springer.

Lai, C. & Zhao, Y. (2006). Noticing And Text-Based Chat, Michigan State University. *Language Learning & Technology. September 2006,* Volume 10, Number 3.

Lai, R. (2011). Critical Thinking: A Literature Review. *Pearson's Research Reports Pearson. Assessment & Information group of Pearson.*

Landragin, F. (2013). *Man-Machine Dialogue: Design and Challenges*. Wiley.

Laningan, L. (2012). *Speech Act Phenomenology*. Springer Netherlands.

Lau, F. (2011). *An Introduction to Critical Thinking and Creativity: Think More, Think Better.* Wiley.

Laurillard, D. (2013). *Teaching as a Design Science: Building Pedagogical Patterns for Learning and Technology*. Taylor & Francis.

Lazar, J., Feng, H. & Hochheiser, H. (2010). *Research Methods in Human-Computer Interaction*. John Wiley & Sons.

Le, N., & Huse, N. (2016). Evaluation of the Formal Model for the Socratic Method. In Micarelli, A., Stamper, J. & Panourgia, K. (Eds.). *Intelligent Tutoring Systems: 13th International Conference, ITS 2016, Zagreb, Croatia, June 7-10, 2016. Proceedings.* Springer International Publishing.

Lee, G., Kim, H. & Jeong, H. (2015). *Natural Language Dialog Systems and Intelligent Assistants.* Springer International Publishing.

Lee, H., Kim, H. & Seo, J. (2006). Efficient Domain Action Classification Using Neural Networks. In Wang, J., Chan, L. & Wang, L. (Eds.). *Neural Information Processing: 13th International Conference, ICONIP 2006, Hong Kong, China, October 3-6, 2006, Proceedings.* Berlin Heidelberg: Springer.

Lee, L. (2002). Enhancing Learners' Communication Skills through Svnchronous Electronic Iiteraction and Task-Based Instruction. *University of New Hampshire. Foreign Language Annals*, VOL. 35, NO. I.

Lehman, B., Mello, S., Cade, W., & Perso, N. (2012) How do they do it? Investigating dialogue moves with dialogue modes in Expert human Tutoring. In Cerri, A., Clancey, J., Papadourakis, G. & Panourgia, K. (Eds.). *Intelligent Tutoring Systems: 11th International Conference, ITS 2012, Chania, Crete, Greece, June 14-18, 2012. Proceedings.* Berlin Heidelberg: Springer.

Lehtinen, B. (2008). Accessing Language Using Online Chatbots. *Peerspectives*, (1), 3–6.

Lemon, O. & Pietquin, O. (2012). *Data-Driven Methods for Adaptive Spoken Dialogue Systems: Computational Learning for Conversational Interfaces*. New York: Springer.

Lemus, R., Seibold, R., Flanagin, J. & Metzger, J. (2004). Argument and decision making in computer mediated groups. *Journal of Communication*, 54, 302-320.

Lepore, E. & Cumming, S. (2012). *Meaning and Argument: An Introduction to Logic Through Language*. Wiley.

Lepore, E. & Stone, M. (2014). *Imagination and Convention: Distinguishing Grammar and Inference in Language*. Oxford University Press.

Lester, J., Branting K. & Mott, B. (2005) Conversational Agents. In Singh, P. (Eds.). *The Practical Handbook of Internet Computing*. Chapman & Hall/CRC.

Lester, J., Stone, B. & Stelling, G. (2013). Lifelike pedagogical agents for Mixed-Initiative Problem Solving in Constructivist Learning Environment. In Haller, S., Mcroy, S. & Kobsa, A. (Eds.). *Computational Models of Mixed-Initiative Interaction.* Springer Netherlands.

Levinson, S. (1983). *Pragmatics*. Cambridge University Press.

Lewis, A. & Smith, D. (1993) Defining Higher-Order Thinking. *Theory into Practice,* 32:3, pp.131–137.

Li, X. (2012). *Improving The Reliability And Validity Of Wizard-Of-Oz Methods*. Unpublished PhD thesis, University of Huddersfield.

Lichtman, M. (2010). *Understanding and Evaluating Qualitative Educational Research*. SAGE Publications.

Lillyman, S. & Merrix, P. (2012). *Nursing & Health Survival Guide: Portfolios and Reflective Practice*. Pearson Education Limited.

Lim S., Oh, K. & Cho, S. (2011). Spontaneous Topic Change of Dialogue for Conversational Agent Based on Human Cognition And Memory. In Filipe, J., Fred, A. & Sharp, B. (Eds.). *Agents and Artificial Intelligence: Second International Conference, ICAART 2010, Valencia, Spain, January 22-24, 2010. Revised Selected Papers.* Springer.

Lim, L. & Sudweeks, F. (2008a). Chatting to learn: A case study on student experiences of online moderated synchronous discussions in virtual tutorials. In Negash, S. (Eds.). *Handbook of Distance Learning for Real-Time and Asynchronous Information Technology Education.* Information Science Reference.

Lim, L. & Sudweeks, F. (2008b). Discourse and Network Analyses of Learning Conversations. In Kelsey, S. (Eds.). *Handbook of Research on Computer Mediated Communication*. Information Science Reference.

Limon, M. (2002). Conceptual Change in History. In Limón, M. & Mason, L. (Eds.). *Reconsidering Conceptual Change: Issues in Theory and Practice.* Springer.

Lindhard, N. (1987). *Guidance in the Classroom.* Maskew Miller Longman.

Linell, P. (1998). *Approaching Dialogue: Talk, Interaction and Contexts in Dialogical Perspectives*. Benjamins Publishing Company.

Lipman, M. (1988). Critical thinking-What can it be? *Educational Leadership, 46*(1), 38–43.

Lipman, M. (2003). *Thinking in Education.* Cambridge University Press.

Lisowaska, A. & Armstrong, S. (2007). Multimodal Input for Meeting Browsing and Retrival Interfaces: Preliminary Findings. In Renals, S., Bengio, S. & Fiskus, J. (Eds.). *Machine Learning for Multimodal Interaction: Third International Workshop, MLMI 2006, Bethesda, MD, USA, May 1-4, 2006, Revised Selected Papers.* Berlin Heidelberg: Springer.

Lisowska, A., Rajman, M. & Bui, T. (2005). ARCHIVUS: A System For Accessing The Content of Recorded Multimodal Meeting. In Bengio, S. & Bourlard, H. (Eds.). *Machine Learning for Multimodal Interaction: First International Workshop, MLMI 2004, Martigny, Switzerland, June 21-23, 2004, Revised Selected Papers.* Berlin Heidelberg: Springer.

Litman, J. (1985).*Plan recognition and discourse analysis: an integrated approach to understanding dialogues*. Unpublished PhD thesis, Department of Computer Science. University of Rochester.

Littleton, K. & Howe, C. (2010). *Educational Dialogues: Understanding and Promoting Productive Interaction*. Taylor & Francis.

Littleton, K. & Mercer, N. (2013). *Interthinking: Putting Talk to Work.* Taylor & Francis.

Livnat, Z. (2012). *Dialogue, Science and Academic Writing.* John Benjamins Publishing Company.

LLC. (2014). Dictionary.com. [ONLINE] Available at: http://www.dictionary.com/. [Accessed 12/02/ 2016].

LLC, R. (2010). *Maximize Your Writing Score on the SAT: An Expert's Guide to Mastering the SAT Writing Section.* Dog Ear Publishing, LLC.

Llewellyn, D. (2013). *Inquire Within*. SAGE Publications.

Lochbaum, E. (1993). A collaborative planning approach to discourse understanding. *Technical Report TR-20-93, Harvard University*.

Lockelt, M. (2011). Design and Implementation Issues for Convincing Conversational agents. In Perez-Marin, D. (Eds.). *Conversational Agents and Natural Language Interaction: Techniques and Effective Practices: Techniques and Effective Practices.* Information Science Reference.

Lodico, G., Spaulding, T. & Voegtle, H. (2010). *Methods in Educational Research: From Theory to Practice*. Wiley.

Long, M., Wood, C., Littleton, K., Passenger, T. & Sheehy, K. (2010). *The Psychology of Education*. Taylor & Francis.

Lopez-Cozar, R., Callejas, Z., Espejo, G. & Griol, D. (2011). Enhancement of Conversational agent by Means of Multimodal Interaction. In Perez-Marin, D. (Eds.). *Conversational Agents and Natural*

Language Interaction: Techniques and Effective Practices: Techniques and Effective Practices. Information Science Reference.

Lovitts, E. & Wert, L. (2009). *Developing Quality Dissertations in the Social Sciences: A Graduate Student's Guide to Achieving Excellence*. Stylus.

Luckhardt, G. & Bechtel, W. (2014). *How To Do Things With Logic*. Taylor & Francis.

Luis, A., Ivan, P., Meza, V. & Salinas, L. (2010). Dialogue Model Specification and Interpretation for Intelligent Multimodal HCI. In Kuri-Morales, A. & Simari, R. (Eds.). *Advances in Artificial Intelligence - IBERAMIA 2010: 12th Ibero-American Conference on AI, Bahía Blanca, Argentina, November 1-5, 2010, Proceedings.* Berlin Heidelberg: Springer.

Luppicini, R. (2007). *Online Learning Communities.* IAP.

Luque, B. (2011). *Giving Reasons: A Linguistic-Pragmatic Approach to Argumentation Theory.* Springer Netherlands.

Lynch, C. (2010). *Activity Systems Analysis Methods: Understanding Complex Learning Environments.* Springer US.

MacKenzie, D. (1979). Question-begging in Non-cumulative Systems. *Journal of Philosophical Logic*, 8, pp.117-133.

Macagno, F. (2015). Reporting and Interpreting Intention in Defamation Law. In Capone, A., Kiefer, F. & Piparo, L. (Eds.). *Indirect Reports and Pragmatics: Interdisciplinary Studies.* Springer International Publishing.

Magnusson, E. & Marecek, J. (2015). *Doing Interview-based Qualitative Research: A Learner's Guide.* Cambridge University Press.

Major, H., Harris, S. & Zakrajsek, T. (2015). *Teaching for Learning: 101 Intentionally Designed Educational Activities to Put Students on the Path to Success.* Taylor & Francis.

Maltby, J., Williams, G., Mcgarry, J. & DAY, L. (2014). *Research Methods for Nursing and Healthcare.* Taylor & Francis.

Mancini, M. (2008). *Multimodal Distinctive Behavior for Expressive Embodied Conversational Agents*. Universal Publishers.

Marin, D. & Nieto, I. (2011). *Conversational Agents and Natural Language Interaction: Techniques and Effective Practices: Techniques and Effective Practices.* Information Science Reference.

Marin, D. & Nieto, I. (2012). A proposal to Model Interaction from the Analysis of Student-Pedagogic Conversational Agent. In Griol Barres, D. (Eds.). *Technologies for Inclusive Education: Beyond Traditional Integration Approaches: Beyond Traditional Integration Approaches.* Information Science Reference.

Markee, N. (2000). *Conversation Analysis.* Taylor & Francis.

Markman, K. (2013). Conversational Coherence in Small Group Chat. In Herring, S., Stein, D. & Virtanen, T. (Eds.). *Pragmatics of Computer-Mediated Communication*. De Gruyter.

Marshall, C. & Rossman, B. (2015). *Designing Qualitative Research*. SAGE Publications.

Martin, D. & Loomis, K. (2013). *Building Teachers: A Constructivist Approach to Introducing Education.* Cengage Learning.

Martin, B., Hanington, B. & Hanington, M. (2012). *Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions.* Rockport Publishers.

Martin, L. & Briggs, J. (1986). *The Affective and Cognitive Domains: Integration for Instruction and Research*. Educational Technology Publications.

Martinich, P. & Sosa, D. (2008). *A Companion to Analytic Philosophy*. Wiley.

Marzano, J. (2007). *The new taxonomy of educational objectives*. Corwin Press.

Mason, L. (2002). Developing Epistemological Thinking to Foster Conceptual Change in Different Domains. In Limón, M. & Mason, L. (Eds.). *Reconsidering Conceptual Change: Issues in Theory and Practice.* Springer.

Matsui, T. (2000). *Bridging and Relevance*. Benjamins Pub.

Matthews, R. & Lally, J. (2010). *The Thinking Teacher's Toolkit: Critical Thinking, Thinking Skills and Global Perspectives.* Bloomsbury Academic.

Maxwell, A. (2012). *Qualitative Research Design: An Interactive Approach: An Interactive Approach*. SAGE Publications.

Mayers, C. (2008). *Turn-taking in Cross-sex and Cross-cultural Communication.* GRIN Verlag.

Mazzotta, I., Novielli, N., Silvestri, V. & de Rosis, F. (2007). ‘O Francesca, ma che sei grulla?’ Emotions and Irony in Persuasion Dialogues. In Congress, A., Basili, R. & Pazienza, T. (Eds.). *AI*IA 2007: Artificial Intelligence and Human-Oriented Computing: 10th Congress of the Italian Association for Artificial Intelligence, Rome, Italy, September 10-13, 2007, Proceedings*. Springer.

McAlister, S., Ravenscroft, A. & Scanlon, E. (2004). Combining interaction and context design to support collaborative argumentation using a tool for synchronous CMC. *Journal of Computer Assisted Learning: Special Issue: Developing dialogue for learning,* 20/3, 194-204

McAdoo, O. (2014). *AS Critical Thinking for AQA*. Taylor & Francis.

McBrien, L., Jones, P. & Cheng, R. (2009). Virtual Spaces: Employing a synchronous online classroom to facilitate student engagement in online learning. *International Review of Research in Open and Distance Learning,* 10(3). ISSN: 1492-3831.

McCarthy, M. (1991). *Discourse Analysis for Language Teachers.* Cambridge University Press.

McCarthy, M. (2001). Discourse. In Carter R. & Nunan, D. (Eds.). *The Cambridge Guide to Teaching English to Speakers of Other Languages.* Cambridge University press.

McDonald, C. & McRobbie, C. (2011). Argumentation and Numbers. In Fraser, B., Tobin, K. & Mcrobbie, J. (Eds.). *Second International Handbook of Science Education*. Springer Netherlands.

McGregor, D. (2007). *Developing Thinking; Developing Learning*. McGraw-Hill International (UK) Limited.

McHoul, A. (1978). The organisation of tums at förmal talk in the classroom. *Language in Society.* 7, pp.183-213.

Mckeachie, W. & Svinicki, M. (2013). *McKeachie's Teaching Tips*. Cengage Learning.

McLeod, G. (2003). Learning Theory and Instructional Design. *Learning Matters*, 2: 35–53.

McLeod, S. (2008). *Case Study Method in Psychology - Simply Psychology*. [Online] Available at: http://www.simplypsychology.org/case-study.html. [Accessed 11/07/2016].

McQueen, P. & McQueen, H. (2010). *Key Concepts in Philosophy*. Palgrave Macmillan.

McTear, F. & Raman, V. (2004). *Spoken Dialogue Technology: Toward the Conversational User Interface*. London: Springer.

McTear, F. & Raman, V. (2011). *Spoken Dialogue Technology: Toward the Conversational User Interface*. London: Springer.

McTear, M., Callejas, Z. & Griol, D. (2016). *The Conversational Interface: Talking to Smart Devices*. Springer International Publishing.

McTighe, J. & Wiggins, P. (2013). *Essential Questions: Opening Doors to Student Understanding*. ASCD.

Meena, K. & R. Sivakumar (2014). *Human-Computer Interaction*. PHI Learning.

Melichar, M. & Cenek, P. (2006). From vocal to Multimodal dialogue Management. In Machinery, C., Sigchi, L. & Library, D. (Eds.). *International Conference on Multimodal Interfaces.* Association for Computing Machinery.

Mellenbergh, J. (2008). *Advising on Research Methods: Proceedings of the 2007 KNAW colloquium*. Johannes van Kessel Publishing.

Mencia, B., Pardo, D., Trapote, A. & Gomez, L. (2011). Designing ECAs to improve Robustness of Human-Machine Dialogue. In Perez-Marin, D. (Eds.). *Conversational Agents and Natural Language Interaction: Techniques and Effective Practices: Techniques and Effective Practices.* Information Science Reference.

Mencia, L., David, D., Pardo, A., Hernandez, T., Luis, A. & Hernandez, G. (2013). Embodied Conversational Agents in Interactive Applications for Children with Special Educational Needs. In Management Association. (Eds.). *Assistive Technologies: Concepts, Methodologies, Tools, and Applications: Concepts, Methodologies, Tools, and Applications*. Information Science Reference.

Mercer, N. (1995). *The Guided Construction of Knowledge: Talk Amongst Teachers and Learners*. Multilingual Matters.

Mercer, N. (2000). *Words and Minds: How We Use Language to Think Together and Get Things Done.* Routledge.

Mercer. N. (2003). Helping children to talk and think together more effectively. *Educational Dialogue Research Unit*. The Open University, UK.

Mercer, N. (2004) Sociocultural discourse analysis: analysing classroom talk as a social mode of thinking. *Journal ofApplied Linguistics,* 1(2): 137–168.

Mercer, N. (2008). Talk and the development of reasoning and understanding. *Human Development*, 51, 1, 90-100.

Mercer, N. (2009). Developing Argumentation: Lessons Learned in the Primary School. In Mirza, N & Perret-Clermont, N. (Eds.). *Argumentation and Education: Theoretical Foundations and Practices.* Springer US.

Mercer, N., Dawes, L., Wegerif, R. & Sams, C. (2004). Reasoning as a scientist: Ways of helping children to use language to learn science. *British Educational Research Journal*, 30(3) 359 -377

Mercer, N. & Hodgkinson, S. (2008). *Exploring Talk in School: Inspired by the Work of Douglas Barnes*, SAGE Publications.

Mercer, N., Karen. L. & Dawes. L. (2005). Talking and thinking together at Key Stage 1. *Early Years: An International Journal of Research and Development,* 25(2), 167 -182.

Mercer, N. & Littleton, K. (2007). *Dialogue and the Development of Children's Thinking: A Sociocultural Approach.* Taylor & Francis.

Meredith, S. & Newton, B. (2003). Models of eLearning: Technology Promise Vs Learner Needs Literature Review. *The International Journal of Management*.

Merriam, B. & Tisdell, J. (2015). *Qualitative Research: A Guide to Design and Implementation*. Wiley.

Merriam, B. (2009). Q*ualitative Research: A Guide to Design and Implementation*. John Wiley & Sons.

Meskill, C. (2013). *Online Teaching and Learning: Sociocultural Perspectives*. Bloomsbury Academic.

Meyer, A. (2014). *Student Engagement Online: What Works and Why: ASHE Higher Education Report*. Wiley.

Mihailidis, A. & Bardram, E. (2006). *Pervasive Computing in Healthcare.* CRC Press.

Miles, B. & Huberman, M. (1994). *Qualitative Data Analysis: An Expanded Sourcebook*. SAGE Publications.

Miles, B., Huberman, M. & Saldaña, J. (2013). *Qualitative Data Analysis: A Methods Sourcebook*. SAGE Publications.

Miller, G. & DIngwall, R. (1997). *Context and Method in Qualitative Research*. SAGE Publications.

Miller, H. (2001). *Speech Acts in Literature*. Stanford University Press.

Millett, S. (2015). *Patterns, Principles and Practices of Domain-Driven Design*. Wiley.

Minker, W., Bühler, D. & Dybkjær, L. (2005). *Spoken Multimodal Human-Computer Dialogue in Mobile Environments*. Springer Netherlands.

Minker, W., Lee, G., Nakamura, S. & Mariani, J. (2010). *Spoken Dialogue Systems Technology and Design.* New York: Springer.

Mirza, C. (2010). Investigating The Socio-Constructivist Dimension of Online Interactions: The case of synchronous audio-graphic conferencing systems. *Newcastle Working Papers in Linguistics*, 16 pp.89–109.

Missimer, A. (2004). *Good Arguments: An Introduction to Critical Thinking.* Pearson/Prentice Hall.

Mitchell, S., Prior, P., Bilbro, R., Peake, K., See, H., & Andrews, R. (2008). A reflexive approach to interview data in an investigation of argument. *International Journal of Research & Method in Education*, 31/3: 229–241.

Moeller, V. & Moeller, M. (2014). *Socratic Seminars in High School: Texts and Films That Engage Students in Reflective Thinking and Close Reading.* Taylor & Francis.

Moller, S. (2006). *Quality of Telephone-Based Spoken Dialogue Systems*. Springer US.

Montero, C. & Araki, K. (2007). Discovering Critically Self-Organized Chat. In Abraham, A., Dote, Y., Furuhashi, T., Köppen, M., Ohuchi, A. & Ohsawa, Y. (Eds.). *Soft Computing as Transdisciplinary Science and Technology: Proceedings of the fourth IEEE International Workshop WSTST´05*. Springer.

Moon, J. (2007). *Critical Thinking: An Exploration of Theory and Practice*. Taylor & Francis.

Moore, B. & Stanley, T. (2010). *Critical Thinking and Formative Assessments: Increasing the Rigor in Your Classroom*. Eye On Education.

Moore, G. (1993). Three types of interaction. In Harry, K., John, M. & Keegan, D. (Eds.). *Distance education: new perspectives*. London: Routledge.

Moore, J. (2011). *Critical Thinking and Language: The Challenge of Generic Skills and Disciplinary Discourses*. London: Continuum International Publishing Group.

Morrow, R. & Weston, A. (2011). *A Workbook for Arguments: A Complete Course in Critical Thinking.* Hackett Publishing.

Morse, M. (2013). The Development of Qualitative Nursing Research. In. Beck, T. (Eds.). *Routledge International Handbook of Qualitative Nursing Research.* Taylor & Francis.

Morse, M. & Singleton, J. (2001). Exploring the Technical Aspects of "Fit" in. *Qualitative Health Research*. Vol. 11. No. 6. 841847.

Morton, H., McBreen, H. & Jack, M. (2006). Experimental Evaluation of The Use of ECAS in Ecommerce Application. In Ruttkay, Z. & Pelachaud, C. (Eds.). *From Brows to Trust: Evaluating Embodied Conversational Agents*. Springer Netherlands.

Moubaidding, A. & Obeid, N. (2008). Dialogue and Argumentation in Multi-agent Diagnosis. In Nguyen, N. & Katarzyniak, R. (Eds.). *New Challenges in Applied Intelligence Technologies*. Springer.

Moule, P. (2007). Challenging the five-stage model for e-learning: A new approach. *ALT-J: research in learning technology,* 15 (1). pp.37-50.

Mouton, J. & Marais, C. (1988). *Basic Concepts in the Methodology of the Social Sciences*. Human Sciences Research Council.

Mozgovoy, M. (2009). *Algorithms, Languages, Automata, and Compilers: A Practical Approach*. Jones & Bartlett Learning.

Munhall, L. (2000). *Qualitative Research Proposals and Reports: A Guide*. Jones and Bartlett.

Myers, P. (2012). *The Teacher's Reflective Practice Handbook: Becoming an Extended Professional through Capturing Evidence-Informed Practice*. Taylor & Francis.

Narita, T. & Kitamura, Y. (2010). Persuasive Conversational Agent with Persuasion Tactics. In Ploug, T., Hasle, P. & Oinas-Kukkonen, H. (Eds.). *Persuasive Technology: 5th International Conference, PERSUASIVE 2010, Copenhagen, Denmark, June 7-10, 2010, Proceedings*. Berlin Heidelberg: Springer.

Neel, F. & Minker, W. (2012). Multimodal Speech System. In Ponting, K. (Eds.). *Computational Models of Speech Pattern Processing*. Berlin Heidelberg: Springer.

Neustein, A. (2013). Sequence Package Analysis: A new Natural Language Method for Mining User-Generated Content for Mobile Uses. In Neustein, A. & Markowitz, A. (Eds.). *Mobile Speech and Advanced Natural Language Solutions*. New York: Springer.

Neville, C. (1981). *Reconstruction of Thinking: Self Development in Zen, Swordsmanship, and Psychotherapy.* State University of New York Press.

Newby, P. (2014). *Research Methods for Education, Second Edition.* Taylor & Francis.

Newing, H. (2010). *Conducting Research in Conservation: Social Science Methods and Practice.* Taylor & Francis.

Newton, C. (2012). *Heart-Deep Teaching.* B&H Publishing Group.

Newton, P., Driver, R. & Osborne, J. (1999). The place of argumentation in the pedagogy of school science. *International Journal of Science Education*, 21, 553-576.

Nguyen, H., Kasper, G. & Center, R. (2009). *Talk-in-interaction: Multilingual Perspectives*. National Foreign Language Resource Center-University of Hawaii.

Nickerson, S. (2013). *Reflections on Reasoning*. Taylor & Francis.

Nicolas, M. (2009). Online Discourse - e-Primer series. Ako Aotearoa Northern Hub through the regional hub project fund. *Laidlaw College.*

Nielsen, J. (1994). *Usability Engineering*. Morgan Kaufmann.

Nishida, T. (2012). An Engineering Approach to Conversational Informatics. In Okumura, M., Bekki, D. & Satoh, K. (2012). *New Frontiers in Artificial Intelligence: JSAI-isAI 2011 Workshops, LENLS, JURISIN, ALSIP, MiMI, Takamatsu, Japan, December 1-2, 2011. Revised Selected Papers.* Berlin Heidelberg: Springer.

Nishida, T., Nakazawa, A., Ohmoto, Y. & Mohammad, Y. (2014). *Conversational Informatics: A Data-Intensive Approach with Emphasis on Nonverbal Communication*. Springer Japan.

Nolan, B. (2014). *Extending a lexical functional grammar through speech acts, constructions and conversational software agents*. In Nolan, B. & Periñán-Pascual, C. (Eds.). *Language Processing and Grammars: The role of functionally oriented computational models*. John Benjamins Publishing Company.

Norman, T., Carbogim, D., Krabbe, E. & Walton, D. (2013). Argument and Multi-Agent Systems. In Reed, C. & Norman, T. (Eds.). *Argumentation Machines: New Frontiers in Argument and Computation*. Springer Netherlands.

North, J. & Macal, C. (2007). *Managing Business Complexity: Discovering Strategic Solutions with Agent-Based Modeling and Simulation.* Oxford University Press.

North, S., Coffin, C. & Hewings, A. (2008). Using exchange structure analysis to explore argument in text-based computer conferences. *International Journal of Research and Method in Education,* 31(3) 257 -276.

Novielli, N. & Strapparava, C. (2011). Dialogue Act classification Exploiting Lexical Semantic. In Perez-Marin, D. (Eds.). *Conversational Agents and Natural Language Interaction: Techniques and Effective Practices: Techniques and Effective Practices.* Information Science Reference.

Nugent, M. & Vitale, A. (2015). *Fundamentals Success A Q&A Review Applying Critical Thinking to Test Taking*. F. A. Davis Company.

Oakley, L. (2004). *Cognitive Development*. Routledge

O'dwyer, M. & Bernauer, A. (2013). *Quantitative Research for the Qualitative Researcher*. SAGE Publications.

Oermann, H. & Gaberson, B. (2013). *Evaluation and Testing in Nursing Education.* (4th edition). Springer Publishing Company.

Ohtake, K., Misu, T., Kashioka, H. & Nakamura, S. (2010). Dialogue Acts Annotation to construct Dialogue Systems for Consulting. In Minker, W., Lee, G., Nakamura, S. & Mariani, J. (2010). *Spoken Dialogue Systems Technology and Design.* New York: Springer.

Okada, A. (2014). Scaffolding School Students' Scientific Argumentation in Inquiry-Based Learning with Evidence Maps. In Okada, A., Shum, B. & Sherborne, T. (2014). *Knowledge Cartography: Software Tools and Mapping Techniques*. London: Springer

O'Keeffe, A., McCarthy, M. & Carter, R. (2007). *From Corpus to Classroom: Language Use and Language Teaching*. Cambridge University Press.

Olson, D. & Jason, A. (2015). Participatory Mixed Methods Research. In Hesse-Biber, N. & Johnson, B. (Eds.). *The Oxford Handbook of Multimethod and Mixed Methods Research Inquiry*. Oxford University Press.

Orlich, C., Harder, J., Callahan, C., Trevisan, S. & Brown, H. (2009). *Teaching Strategies: A Guide to Effective Instruction*. Cengage Learning.

Osborne, J., Erduran, S., Simon, S. & Monk, M. (2001). Enhancing the quality of argument in school science. *School Science Review,* 82(301), 63-70.

O'Shea, J., Bandar, Z. & Crockett, K. (2010). A Conversational Agent Framework Using Semantic Analysis. *International Journal of Intelligent Computing Research* (IJICR), 1(1/2).

O'Shea, J., Bander, Z. & Crockett, K. (2011). System Engineering and Conversational Agents. In Tolk, A. & Jain, C. (Eds.). *Intelligent-Based Systems Engineering*. Berlin Heidelberg: Springer.

O'Shea, J., Nguyen, T., Crockett, K., Howlett, J. & Jain, C. (2011). *Agent and Multi-Agent Systems: Technologies and Applications: 5th KES International Conference, KES-AMSTA 2011, Manchester, UK, June 29 -- July 1, 2011, Proceedings*. Berlin Heidelberg: Springer.

Paas, F. & Firssova, O. (2004). Usability evaluation of integrated e-learning. In Jochems, W., Van Merriënboer, J. & Koper, R. (Eds.). *Integrated E-learning.* London: RoutledgeFalmer.

Padget, S. (2012). *Creativity and Critical Thinking*. Taylor & Francis.

Panunzi, S. & Belibani, R. (2012). *E-learning for architecture.* Gangemi Editore.

Park, J. & Bonk, J. (2007a). Synchronous learning experiences: Distance and residential learners' perspectives in a blended graduate course. *Journal of Interactive Online Learning,* 6(3), 245-264.

Park, J. & Bonk, J. (2007b). Is life a Breeze? A case study for promoting synchronous learning in a blended graduate course. *Journal of Online Learning and Teaching (JOLT),* 3(3), 307-323.

Parshall, G., Spray, A., Kalohn, J. & Davey, T. (2012). Practical Considerations in Computer-Based Testing. New York: Springer.

Pasfield, E. (2012). *Online Communication in a Second Language: Social Interaction, Language Use, and Learning Japanese.* Channel View Publications.

Passmore, J. (2010).On teaching to be Critical. In Peters, S. (Eds.). *The Concept of Education (International Library of the Philosophy of Education Volume 17).* Taylor & Francis.

Pathak, P. (2008). *Methodology of Educational Research*. Atlantic Publishers and Distributors.

Patnaik, S. (2015). *College Writing Skills With Reading.* Lulu.com.

Patton, M. (1990). *Qualitative evaluation and research methods*. Beverly Hills, CA: SAGE.

Patton, M. (2014). *Qualitative Research & Evaluation Methods: Integrating Theory and Practice*. SAGE Publications

Paul, R. (1985). Bloom's taxonomy and critical thinking instruction. *Educational Leadership, Association for Supervision & Curriculum Development,* Vol. 42, pp.36.

Paul, R. (1990). *Critical thinking: What every person needs to survive in a rapidly changing world*. Rohnert Park, CA: Foundation for Critical Thinking.

Paul, R. (1991). Dialogical and dialectical thinking. In Costa, A. (Eds.). *Developing minds: A resource book for teaching thinking*. Association for Supervision and Curriculum Development.

Paul, R. (1995). Critical Thinking, The state of education today, and The Goals of the 15th International Conference. *Proceedings of the Fifteenth Annual International Conference on Critical Thinking and Educational Reform: Three waves of research and practice (pp.4-14). Cotati: Center for Critical Thinking and Moral Critique.*

Paul, R. (2009). *The Aspiring Thinker's Guide to Critical Thinking.* Foundation for Critical Thinking.

Paul, R. & Elder, L. (2006a). *Thinker's Guide to the Art of Socratic Questioning.* Foundation for Critical Thinking

Paul, R. & Elder, L. (2006b). *The miniature guide to critical thinking: Concepts and tools.* Dillon Beach CA: Foundation for Critical Thinking.

Paul, R. & Elder, L. (2013). *Critical Thinking: Tools for Taking Charge of Your Professional and Personal Life*. Pearson Education.

Pearn, M. (2003). *Individual Differences and Development in Organisations.* Wiley.

Pelletier, J. & Hazen, A. (2012). Natural deduction. In Gabbay, M. & Woods, J. (Eds.). *Handbook of the history of logic*. Central concepts.

Peng, K. & Nisbett, A. (2000). Culture, Dialectics, and Reasoning About Contradiction. *American Psychologist*, 54(9), 741-54.

Perez-Marin, D. (2011). *Conversational Agents and Natural Language Interaction: Techniques and Effective Practices: Techniques and Effective Practices.* Information Science Reference.

Perin, C. (2010). Descartes and the Legacy of ancient skepticism. In Broughton, J. & Carriero, J. (Eds.). *A Companion to Descartes.* John Wiley & Sons.

Pershing, J., Stolovitch, D. & Keeps, J. (2006). *Handbook of Human Performance Technology: Principles, Practices, and Potential*. Wiley.

Perren, J. (2014). Producing pathways to Proficient Pronunciation with Learner-Designed Pronunciation Station. In Management Association. (Eds.). *Computational Linguistics: Concepts, Methodologies, Tools, and Applications: Concepts, Methodologies, Tools, and Applications*. IGI Global.

Peter, C. & Beale, R. (2008). *Affect and Emotion in Human-Computer Interaction: From Theory to Applications.* Berlin Heidelberg: Springer.

Peters, M. (2008). Kinds of Thinking, Styles of Reasoning. In Mason, M. (2008). *Critical Thinking and Learning*. Blackwell Pub.

Peterson, M. (2013). Task-based Language Teaching in Network-Based CALL: An Analysis of Research on Learner Interaction in Synchronous CMC. In Thomas, M. & Reinders, H. (Eds.). *Task-Based Language Learning and Teaching with Technology*. Bloomsbury Publishing.

Pethuraja, S. (2015). *Massive Open Online Courses (MOOCs) For Everyone.* Pethuraja.S.

Petrie, H., Schlieder, C., Blenkhorn, P., Evans, G., King, A., Ioannidis, G., Gallagher, B., Crombie, D., Mager, R. & Alafaci, M. (2002). *TeDUB: A System for Presneting and Exploring Technical Drawings for Blind People.* In Miesenberger, K., Klaus, J. & Zagler, W. (Eds.). *Computers Helping People with Special Needs: 8th International Conference, ICCHP 2002, Linz, Austria, July 15-20, Proceedings.* Springer.

Phillips, H. & Bostian, P. (2011). *The Purposeful Argument: A Practical Guide.* Cengage Learning.

Phillips, N. & Hardy, C. (2002). *Discourse Analysis: Investigating Processes of Social Construction.* SAGE Publications.

Phye, D. (1997). *Handbook of Academic Learning: Construction of Knowledge*. Elsevier Science.

Pietquin, O. (2005). *A Framework for Unsupervised Learning of Dialogue Strategie*. Presses Universities De Louvain.

Pietquin, O. (2004). *A Framework for Unsupervised Learning of Dialogue Strategies.* Presses Universities De Louvain.

Pietquin, O. (2009). Natural Language and Dialogue Processing. In Thiran, P., Marqués, F. & Bourlard, H. (Eds.). *Multimodal Signal Processing: Theory and applications for human-computer interaction*. Elsevier Science.

Pike, R. (2011). *Assessing the Generic Outcomes of College: Selections from Assessment Measures*. Wiley.

Pilkington, R. (1999). *Analysing Educational Discourse: The DISCOUNT Scheme (CBLU Technical Report 99/2).* Leeds: Computer Based Learning Unit, The University of Leeds, UK.

Pilkington, R. (2001). Analysing educational dialogue interaction: Towards models that support learning (Introduction to the IJAIED Special Issue on Analysing Educational Dialogue). *International Journal of Artificial Intelligence in Education*, 12, 1-7.

Pilkington, R. (2015). *Discourse, Dialogue and Technology Enhanced Learning*. Taylor & Francis.

Pilkington R. & Walker, A. (2003a). Computer mediated argumentation in Higher Education: Developing Discussion Skills through Roles", *Proceedings of the Third International Conference on Networked Learning* 2002, Banks S; Goodyear P; Hodgson V; McConnell D. (Eds.). Sheffield University.

Pilkington, R. & Walker, S. (2003b). Facilitating debate in networked learning: reflecting on online synchronous discussion in higher education. *Instructional Science*, 31(1-2), 41-63.

Pilkington, R. & Walker, A. (2003c). Using CMC to Develop Argumentation Skills in Children with a Literacy Deficit. In Adriessen, J. & Baker, M. & Suthers, E. (Eds.). *Arguing to Learn: Confronting Cognitions in Computer-Supported Collaborative Learning Environments.* Springer Netherlands.

Pitler, H. (2007). *Using Technology with Classroom Instruction that Works*. Association for Supervision and Curriculum Development.

Plonsky, L. (2015). *Advancing Quantitative Methods in Second Language Research*. Taylor & Francis.

Polit, F. & Beck, T. (2004). *Nursing Research: Principles and Methods*. Lippincott Williams & Wilkins.

Polit, F. & Beck, T. (2013). *Essentials of Nursing Research: Appraising Evidence for Nursing Practice*. Wolters Kluwer Health.

Preece, J., Rogers, Y. & Sharp, H. (2015). *Interaction Design: Beyond Human-Computer Interaction.* Wiley.

Prensky, M. (2001). *Digital Natives, Digital Immigrants. On the Horizon.* MCB University Press

Pridham, F. (2013). *The Language of Conversation*. Taylor & Francis.

Pring, R. (2000). *Philosophy of educational research*. London: Continuum.

ProDAIT. (2006).*Professional Development For Academics Involved In Teaching*. [Online] Available at: http://www.prodait.iehosting.co.uk/approaches/dialogue/thinking.php. [Accessed 27/06/2016].

Psaltis, C. & ZAPITI, A. (2014). *Interaction, Communication and Development: Psychological Development as a Social Process.* Taylor & Francis.

Putnam, L. & Roloff, E. (1992). *Communication and Negotiation*. SAGE Publications.

Pykhtina, O., Madeline, B., Gavin, W., Sue, P., Ahmed, K. & Patrick, P. (2012). Magic Land: The Design and Evaluation of an Interactive Tabletop Supporting Therapeutic Play with Children. *Proceedings of the ACM Conference on Designing Interactive Systems (DIS).* Newcastle, UK, pp.136-145.

Quarteroni, S. & Manandhar, S. (2007). A Chatbot-based Interactive Question Answering System. *Decalog 2007: Proceedings of the 11th Workshop on the Semantics and Pragmatics of Dialogue, pages 83–90.rento, Italy, 30 May – 1 June 2007.* Ed. Ron Artstein & Laure Vieu.

Quarteroni, S. & Manandhar, S. (2009). Designing an interactive open domain question answering system*. Natural Language Engineering*, 73–95.

Rada, R. & Michailidis, A. (2012). *Interactive Media*. New York: Springer.

Rahimi, M. (2015). *Handbook of Research on Individual Differences in Computer-Assisted Language Learning*. IGI Global.

Rainbolt, W. & Dwyer, L. (2012). *Critical Thinking: The Art of Argument*. Cengage Learning.

Ram, A. & Leake, B. (1995). *Goal-driven Learning*. Bradford Books.

Ramanathan, R. (2009). *The Role of Organisational Change Management in Offshore Outsourcing of Information Technology Services: Qualitative Case Studies from a Multinational Pharmaceutical Company*. Universal Publishers.

Ravenscroft, A. (2000). Designing Argumentation for Conceptual Development. *Computers & Education, 34 (2000),* pp.241-255. Elsevier Science Ltd.

Ravenscroft, A. (2001). Designing e-learning interactions in 21C: Revisiting and rethinking the role of theory. *European Journal of Education: Special edition on On-line Learning*, Vol. 36, No. 2, pp.133-156.

Ravenscroft, A. (2003). From conditioning to learning communities: implications of fifty years of research in e-learning interaction design. *Association for Learning Technology Journal, ALT-J,* 11(3), 4–18.

Ravenscroft, A. (2007). Promoting thinking and conceptual change with digital dialogue games. *Journal of Computer Assisted Learning (JCAL)*, 23(6), 453-465.

Ravenscroft, A. (2011). Dialogue and Connectivism: A New Approach to Understanding and Promising Dialogue-Rich Networked Learning. *Learning Technology Research Institute (LTRI), London Metropolitan University,* UK. [Online] Available at: http://www.irrodl.org/index.php/irrodl/article/view/934. [Accessed 25/02/2016].

Ravenscroft, A. (2013). Towards Highly communicative e-learning communities, Developing a socio-cultural framework for cognitive change. In Bayne, S. & Land, R. (Eds.). *Education in Cyberspace*. Taylor & Francis

Ravenscroft, A. & Matheson, P. (2002). Developing and Evaluating Dialogue Games for Collaborative Elearning Interaction. *Journal of Computer Assisted Learning, Special Issue: Context, Collaboration, Computers and Learning*, 18(1), pp.93-102.

Ravenscroft, A. & McAlister, S. (2006a). Designing interaction as a dialogue game: linking social and conceptual dimensions of the learning process. In Juwah, C. (Eds.). *Interactions in Online Education: Implications for Theory and Practice*. Taylor & Francis.

Ravenscroft, A. & McAlister, S. (2006b). Digital Games and Learning in Cyberspace: A Dialogical Approach, *E-Learning Journal, Special Issue of Ideas in Cyberspace 2005 Symposium*, Vol. 3, No 1, pp 38-51.

Ravenscroft, A. & Pilkington, R. (2000). Investigation by Design: Developing Dialogue Models to Support Reasoning and Conceptual Change. *International Journal of Artificial Intelligence in Education: Special Issue on Analysing Educational Dialogue Interaction: From Analysis to Models that Support Learning,* Vol. 11, Part 1, pp.273-298.

Ravenscroft, A., Sagar, M., Baur, E. & Oriogun, P. (2008). Ambient pedagogies, meaningful learning and social software. In Hatzipanagos, S. (Eds.). *Handbook of Research on Social Software and Developing Community Ontologies.* Information Science Reference.

Ravenscroft, A., Wegerif, R. & Hartley, J. (2007). Reclaiming thinking: Dialectic, dialogic and learning in the digital age. In Underwood, J & Dockrell, J. (Eds.). *Learning through Digital Technologies*. British Psychological Society.

Rayner, M. (2000). *The Spoken Language Translator*. Cambridge University Press.

Reed, C. & Norman, T. (2013). *Argumentation Machines: New Frontiers in Argument and Computation.* Springer Netherlands.

Reed, J. (1998). *Effect of a model for critical thinking on student achievement in primary source document analysis and interpretation, argumentative reasoning, critical thinking dispositions, and history content in a community college history course.* Unpublished PhD thesis. Graduate School. University of South Florida. Tampa, Florida.

Resnick, L. (1987). *Education and Learning to Think*. National Academies Press.

Reyes, P. &Tchounikine, P. (2004). Redefining the Turn-Taking Notion in Mediated Communication of Virtual Learning Communities. In Lester, C., VIcari, M. & Paraguacu, F. (Eds.). *Intelligent Tutoring Systems: 7th International Conference, ITS 2004, Maceió, Alagoas, Brazil, August 30 - September 3, 2004, Proceedings.* Springer.

Reznitskaya, A., Anderson, C., McNurlen, B., Nguyen-Jahiel, K., Archodidou, A. & Kim, S. (2001). Influence of oral discussion on Written Argument. *Discourse Processes,* 32, 2-3,155-175.

Reznitskaya, A., Kuo, L., Clark, A., Miller, B., Jadallah, M. & Anderson, C. (2009). Collaborative Reasoning: A dialogic approach to group discussions. *Cambridge Journal of Education,* 39(1), 29–48.

Richards, C. & Miller, K. (2006). *Doing Academic Writing in Education: Connecting the Personal and the Professional.* Taylor & Francis.

Richardson, A. (2010). Pragmatic Approach to Analysing CMC discourse. In Taiwo, R. (Eds.). *Handbook of Research on Discourse Behavior and Digital Communication: Language Structures and Social Interaction: Language Structures and Social Interaction.* Information Science Reference.

Rickel, J. & Johnson, L (2000). Task-Oriented Collaboration with Embodied Agent in Virtual World. In Cassell, J. (2000). *Embodied Conversational Agents.* MIT Press.

Riddle, E. (1999). *Lev Vygotsky's social development theory*. [Online] Available at: http://funwithfcs.uvjvs.wikispaces.net/file/view/LevVygotsky.pdf. [Accessed 14/07/2016].

Riek, D. (2012). Wizard of Oz Studies in HRI: A Systematic Review and New Reporting Guidelines. *Journal of Human-Robot Interaction,* 1(1), 119-136.

Rieke, D. & Sillars, O. (1984). *Argumentation and the Decision Making Process*. Scott, Foresman.

Ries, S (2008). Trust and accountability. In Mühlhäuser, M. (Eds.). *Handbook of Research on Ubiquitous Computing Technology for Real Time Enterprises*. Information Science Reference.

Rieser, V. & Lemon, O. (2008). Learning effective multimodal dialogue strategies from wizard- of-oz data: Bootstrapping and evaluation. *In Proceedings of the 46th Annual Meeting of the Association for Computational Linguistics (ACL/HLT 2008).*

Rieser, V. & Lemon, O. (2011). *Reinforcement Learning for Adaptive Dialogue Systems: A Data-driven Methodology for Dialogue Management and Natural Language Generation.* Berlin Heidelberg: Springer.

Rist, T., Aylett, R., Ballin, D. & Rickel, J. (2003). *Intelligent Virtual Agents: 4th International Workshop, IVA 2003, Kloster Irsee, Germany, September 15-17, 2003, Proceedings*. Berlin Heidelberg: Springer.

Ritchie, J. & Lewis, J. (2003). *Qualitative Research Practice: A Guide for Social Science Students and Researchers*. SAGE Publications.

Ritchie, J., Lewis, J., Nicholls, N. & Ormston, R. (2013). *Qualitative Research Practice: A Guide for Social Science Students and Researchers.* SAGE Publications.

Roberts, M. (2015). *Critical Thinking and Reflection for Mental Health Nursing Students.* SAGE Publications.

Robinson, D. (2001). Asymmetry in action: sequential resources in the negotiation of a prescription request. *Text*, 21:19–54.

Robson, C. (2002). *Real World Research: A Resource for Social Scientists and Practitioner-Researchers*. Wiley.

Rogers, Y., Sharp, H. & Preece, J. (2011). *Interaction Design: Beyond Human - Computer Interaction*. Wiley.

Romiszowski, J. & Mason, R. (1996). Computer-mediated communication. In Jonassen, D. (Eds.). *Handbook of research for educational communications and technology.* New York: Simon and Schuster Macmillan.

Rose, S., Spinks, N. & Canhoto, I. (2014). *Management Research: Applying the Principles*. Taylor & Francis.

Rosen, Y. & Mosharraf, M. (2015). Evidence-Centered Concept Map in Computer-Based Assessment of Critical thinking. In Rosen, Y. (Eds.). *Handbook of Research on Technology Tools for Real-World Skill Development*. IGI Global.

Ross, N. (2005). Quantitative research methods in educational planning. *International Institute for Educational Planning UNESCO*.

Rossen, B., Lind, S. & LoK, B. (2009). Human-Centered Distributed Conversational Modeling: Efficient Modeling of Robust Virtual Human Conversations. In Ruttkay, Z., Kipp, M., Nijholt, A. & Vilhjálmsson, H. (Eds.). *Intelligent Virtual Agents: 9th International Conference, IVA 2009 Amsterdam, The Netherlands, September 14-16, 2009 Proceedings*. Berlin Heidelberg: Springer.

Rosson, M. & Carroll, J. (2002). Scenario-Based Design. In Jacko, J & Sears, A. (Eds.). *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*. Lawrence Erlbaum Associates.

Rovai, P., Baker, D. & Ponton, K. (2013). *Social Science Research Design and Statistics: A Practitioner's Guide to Research Methods and IBM SPSS*. Watertree Press.

Rowley, J. (2002). Using case studies in research. *Management Research News,* 25, 1, 16–27.

Rubin, A. (2009). *Essential Research Methods for Social Work*. Cengage Learning.

Rubin, H., Bukowski, M. & Laursen, P. (2009). *Handbook of Peer Interactions*. Relationships, and Groups, Guilford Press.

Rubin, J. (1994). *Handbook of Usability Testing: How to plan, design, and conduct effective tests*. New York: John Wiley.

Rudas, J. & Fodor, J. (2008). Intelligent System. *Int. J. of Computers, Communications & Control, ISSN 1841-9836, E-ISSN 1841-9844 Vol. III (2008), Suppl. issue: Proceedings of ICCCC 2008,* pp.132-138.

Ruday, S. (2015). *The Argument Writing Toolkit: Using Mentor Texts in Grades 6-8.* Taylor & Francis.

Rudinow, J. & Barry, E. (2007). *Invitation to Critical Thinking*. Thomson Wadsworth.

Ruggiero, R. (2014). *Becoming a Critical Thinker*. Cengage Learning.

Rundquist, T. (2007). *Programming Children to Think Like Computers: Manual for Teachers and Parents.* Nova Media, Incorporated.

Ruttkay, Z. & Pelachaud, C. (2004). *From Brows to Trust: Evaluating Embodied Conversational Agents.* Springer Netherlands.

Ryan, P. (2013). *Sample Size Determination and Power*. Wiley.

Sacks, H., Schegloff, E. & Jefferson, G. (1974). A Simplest Systematics for the Organization of Turn-taking for Conversation. *Language,* 4: 696-735.

Sadowski, J. (2001). Capability and limitations of The Wizard of Oz Evaluation of Speech User Interface. In Smith, J., Koubek, J., Salvendy, G. & Harris, D. (Eds.). *Usability Evaluation and Interface Design: Cognitive Engineering, Intelligent Agents, and Virtual Reality.* Taylor & Francis.

Sagae, A., Johnson, W. & Valente, A. (2011). Conversational Agent in Language and Culture Training. In Perez-Marin, D. (Eds.). *Conversational Agents and Natural Language Interaction: Techniques and Effective Practices: Techniques and Effective Practices.* Information Science Reference.

Salmon, G. (2000). *E-moderating: the key to teaching and learning online*. (1st edition). London: Kogan Page.

Salmon, G. (2002). *E-tivities: the key to active online learning.* London: Taylor and Francis.

Salmon, G. (2007). The Tipping Point. *ALT-J: Research in Learning Technology,* 15(2), 171-172.

Sarbazhosseini, H., Adikari, S. & Keighran, H. (2016). Designing Thinking Framework for Project Portfolio Management. In Marcus, A. (Eds.). *Design, User Experience, and Usability: Design Thinking and Methods: 5th International Conference, DUXU 2016, Held as Part of HCI International 2016, Toronto, Canada, July 17–22, 2016, Proceedings.* Springer International Publishing.

Saunders, M., Lewis, P. & Thronhill, A. (2009). *Research Methods for Business Students*. Financial Times/Prentice Hall.

Savin-Baden, M., Tombs, G., Bhakta, R. & Burden, D. (2015). Students experiences of emotional connection with pedagogical agents. In Khosrow-Pour, M. (Eds.). *Encyclopedia of Information Science and Technology.* Hershey, PA: IGI Global.

Savino, M. & Refice, M. (2003). Acoustic Cues for Classifying Communicative Intention In Dialogue Systems. In Sojka, P., Kopecek, I. & Pala, K. (Eds.). *Text, Speech and Dialogue: Third International Workshop, TSD 2000 Brno, Czech Republic, September 13-16, 2000 Proceedings.* Berlin Heidelberg: Springer

Schaie, W. & Charness, N (2003). *Impact of Technology on Successful Aging*. Springer Publishing Company.

Scharl, A. (2013). *Environmental Online Communication*. London: Springer.

Schegloff, A. (1992). Repair after next turn: The last structurally provided defense of inter-subjectivity in conversation. *American Journal of Sociology,* 97, 1295-1345.

Schegloff, A. (2007). *Sequence Organization in Interaction: Volume 1: A Primer in Conversation Analysis.* Cambridge University Press.

Schegloff, A. & Sacks, H. (1973). Opening up closings. *Semiotica* 8(4), 289-327.

Scheuer, O., Mclaren, B., Loll, F. & Pinkwart, N. (2012). Automated Analysis and Feedback Techniques to Support and Teach Argumentation: A Survey. In Kwart, N. & Mclaren, M. (Eds.). *Educational Technologies for Teaching Argumentation Skills*. Bentham Science Publishers.

Schneider, W. & Lockl, K. (2002).The Development of Metacognitive Knowledge. In Perfect, J. & Schwartz, L. (Eds.). *Applied Metacognition.* Cambridge University Press.

Schreiner, S. (2009). *Handbook of Research on Assessment Technologies, Methods, and Applications in Higher Education*. Information Science Reference.

Schroeder, R. (2012). Merging Critical Thinking and Information Literacy outcomes Making Meaning or Making Strategic Partnerships. In Wilkinson, W. & Bruch, C. (Eds.). *Transforming Information Literacy Programs: Intersecting Frontiers of Self, Library Culture, and Campus Community*. Association of College and Research Libraries. A Division of the American Library Association.

Schwab, P. (2013). *Research Methods for Organizational Studies*. Taylor & Francis.

Schwarz, B. (2009).Argumentation and Learning. In Mirza, M. & Perret-Clermont, N. (Eds.). *Argumentation and Education: Theoretical Foundations and Practices*. Springer US.

Schwienhorst. K. (2004). Native-Speaker/Non-Native-Speaker Discourse in the MOO: Topic Negotiation and Initiation in a Synchronous Text-Based Environment. *Computer Assisted Language Learning*, 17:1, 35-50

Scott, D. & Usher, R. (2011). *Researching Education: Data, Methods and Theory in Educational Enquiry*. Bloomsbury Academic.

Searle, J. (1969). *Speech Acts: An Essay in the Philosophy of Language*. Cambridge University Press.

Searle, J. (1971). *The philosophy of language*. Oxford University Press.

Searle, J. (1975). Indirect Speech Acts. In Cole, P. & Morgan, J. (Eds.). *Syntax and Semantics Volume 3: Speech Acts.* Academic Press, pp59–82.

Searle, J. (1985). *Expression and Meaning: Studies in the Theory of Speech Acts*. Cambridge University Press.

Searle, J. (2008). *Mind, Language And Society: Philosophy In The Real World*. Basic Books.

Searle, J. & Vanderveken, D. (1985). *Foundations of Illocutionary Logic*. Cambridge University Press.

Sears, A. & Jacko, A. (2009). *Human-Computer Interaction: Designing for Diverse Users and Domains.* CRC Press.

Seedhouse, P. (2004). *The Interactional Architecture of the Language Classroom: A Conversation Analysis Perspective*. Wiley.

Sehgal, A. (2005). *Social work*. Isha Books.

Seneff, S. (2006). Interactive Computer Aids for Acquiring Proficiency in Mandarin. In Huo, e. (Eds.). *Proceedings of ISCSLP 2006, Lecture Notes in Computer Science 4274 (pp.1–12).* Berlin Heidelberg: Springer Verlag.

Sensing, T. (2011). *Qualitative Research: A Multi-Methods Approach to Projects for Doctor of Ministry Theses.* Wipf & Stock Publishers.

Serlin, R. (2005). The Advantages and Disadvantages of Online Courses Based on Experiences in Teaching Net Delivered INDV 102; 102: Money, Consumers, and Family. Summer I 2005. [Online]. *ResearchGate*.

Shabo, M. (2010). *Rhetoric, Logic, and Argumentation: A Guide for Student Writers.* Prestwick House.

Shackel, B. & Richardson, S. (1991). *Human Factors for Informatics Usability*. Cambridge University Press.

Shahin, T. (2002). *Computer-Based Design: Engineering Design Conference 2002*. John Wiley & Sons.

Shaw, G. (2000). *Strategies for Managing Computer Software Upgrades*. IGI Global

Shaw, J. (2015). *E-Commerce and the Digital Economy*. Taylor & Francis.

Shavelson, R. (2010). *Measuring College Learning Responsibly: Accountability in a New Era*. Stanford University Press.

Shelly, B. & Rosenblatt, H. (2011). *Systems Analysis and Design*. Cengage Learning.

Sheratt, S., Sher, W., Williams, A. & Gameson, R. (2010). Communication in Construction Design Teams: Moving into Virtual World. In Taiwo, R. (Eds.). *Handbook of Research on Discourse Behavior and Digital Communication: Language Structures and Social Interaction: Language Structures and Social Interaction.* Information Science Reference.

Sherman, R. & Webb, B. (1988). *Qualitative Research in Education: Focus and Methods*. Falmer Press.

Sherman, R. & Webb, B. (2004). *Qualitative Research In Education*. Taylor & Francis.

Shi, H., Robert, J., Tenbrink, T. & Bateman, J. (2010). Modelling Illocutionary Structure: Combining Empirical Studies with Formal Model Analysis. In Gelbukh, A. (Eds.). *Computational Linguistics and Intelligent Text Processing: 11th International Conference, CICLing 2010, Iasi, Romania, March 21-27, 2010, Proceedings.* Springer.

Shultz, J., Florio, S. & Erikson, F. (1982). Where's the Floor? Aspects of the Cultural Organisation of Social Relationships in Communication at Home and in School. In Gilmore, P & Glatthorn, A. (Eds.) *Children In and Out of School: Ethnography and Education.* Washington DC: Center for Applied Linguistics.

Sia, K., Logn, Y. & Ling, M. (2011).Toward a Unified Model of Information Systems Development Success. In Siau, K. (Eds.). *Cross-Disciplinary Models and Applications of Database Management: Advancing Approaches: Advancing Approaches.* Information Science Reference.

Siddiqui, H. (2004). *Technology in Higher Education*. APH Publishing Corporation.

Siddiqui, T. (2012). Issues in Spoken Dilaouge System for Human-Computer Interaction. In Tiwary, S. (Eds.). *Speech, Image, and Language Processing for Human Computer Interaction: Multi-Modal Advancements: Multi-Modal Advancements.* Information Science Reference.

Sidnell, J. (2010). *Conversation Analysis- an introduction*. West Sussex, UK: Wiley-Blackwell.

Sidnell, J. & Stivers, T. (2012). *The Handbook of Conversation Analysis.* Wiley.

Siegel, H. (2013). *Educating Reason*. Taylor & Francis.

Siemens, G. (2004). *Connectivism: A learning theory for the digital age.* Elearnspace.

Silliman, R. & Wilkinson, C. (2007). *Language and Literacy Learning in Schools*. Guilford Press.

Silverman, D. (2010). *Qualitative Research*. SAGE Publications.

Silvervarg, A. (2010). Development Methods for a Social Conversational Agent in a Virtual Learning Environment with an Educational Math Game. *Department of Computer and Information Science. Linköping University.*

Silvervarg, A. & Jonsson, A. (2013). Iterative Development and Evaluation of a Social Conversational Agent. *Department of Computer and Information Science. Linkoping University, Linkoping, Sweden.*

Sim, J. & Wright, C. (2000). *Research in Health Care: Concepts, Designs and Methods.* Nelson Thornes.

Simmons, J. (2015). Moving Beyond a Focus on Delivery Modes to Teaching pedagogy. In Management Association. (Eds.). *Curriculum Design and Classroom Management: Concepts, Methodologies, Tools, and Applications: Concepts, Methodologies, Tools, and Application*s. IGI Global.

Simon, P., McBurney P. & Wooldridge, M. (2004). The Mechanics of Some Formal Inter-agent Dialogues. In Dignum, F. (Eds.). *Advances in Agent Communication: International Workshop on Agent Communication Languages ACL 2003, Melbourne, Australia, July 14, 2003.* Berlin Heidelberg: Springer.

Simons, H. (2009). *Case Study Research in Practice*. SAGE Publications.

Simpson, J. (2005a). Learning electronic literacy skills in an online language learning community. *Computer Assisted Language Learning, 18*(4), 327-345.

Simpson, J. (2005b). Conversational floors in synchronous text-based CMC discourse. *Discourse Studies*, 7, 337-361.

Sinclair, H. & Coulthard, M. (1975). *Towards an analysis of discourse: the English used by teachers and pupils*. Oxford University Press.

Sinclair, H. & Coulthard, M. (1992). Towards an analysis of discourse. In Coulthard, M. (Eds.). *Advances in spoken discourse analysis.* London: Routledge.

Singh, R. (2000). From dialogue to dialectic: Socrates, Kant, Hegel and Marx. *Indian Philosophical* Quarterly.XXVVI NO 3.

Singh, R. (2008). *Consciousness*. Atlantic Publishers & Distributors (P) Limited.

Singh, Y. (2008). *Research Methodology: techniques & Trends*. APH Publishing

Skinner, L. (2010). Successful Strategies in the Online Learning Environment Based on Theories Styles, and Characteristics. In Wang, X. (Eds.). *Encyclopedia of Information Communication Technologies and Adult Education Integration*. Information Science Reference.

Smith, A. (1997). *Human computer factors: a study of users and information systems*. McGraw-Hill.

Smith, C., Cavazza, M., Charlton, D., Zhang, L., Turunen, M. & Hakulinen, J. (2008). Integrating Planning and Dialogue in a Lifestyle gent. In Prendinger, H., Lester, C., Ishizuka, M. (Eds.). *IVA 2008. LNCS (LNAI),* vol. 5208, pp.146–153. Heidelberg: Springer.

Smith, M. (2005). An investigation into the processes of e-pedagogy and e-learning in an online community. *Reflecting Education. Vol 1, No. 1-2, September 2005,* pp.9-23. Institution of Education, London, UK

Smitha, P. (2012). *Inquiry Training Model and Guided Discovery Learning for Fostering Critical Thinking and Scientific Attitude*. Lulu.com.

Smith-Atakan, S. (2006). *Human-computer Interaction*. Thomson.

Snodgrass, R. (2001). *Human Factors in Information Systems*. IRM Press.

Soles, D. (2009). *The Essentials of Academic Writing*. Cengage Learning.

Sottilare, R., Graesser, A., HU, X. & Brawner, K. (2015). *Design Recommendations for Intelligent Tutoring Systems: Authoring Tools and Expert Modeling Techniques*. Army Research Laboratory.

Sowell, J. (2001). *Educational Research: An Integrative Introduction*. McGraw-Hill.

Spence, J. (2016). *Performative Experience Design*. Springer International Publishing.

Spencer, L., Ritchie, J., Lewis, J. & Dillon, L. (2003). *Quality in Qualitative Evaluation: A framework for assessing research evidence.* London: The Cabinet Office.

Spiliotopoulos, T., Papadopoulou, P., Markatos, D. & Kourouetroglou, F. (2010). *Integrating Usability Engineering for Designing the Web Experience: Methodologies and Principles: Methodologies and Principles*. Information Science Reference.

Stacey, E. (2009). *Effective Blended Learning Practices: Evidence-Based Perspectives in ICT-Facilitated Education: Evidence-Based Perspectives in ICT-Facilitated Education.* Information Science Reference.

Stahl, G., Rosé, P., O'Hara, K. & Powell, B. (2010). Supporting group math cognition in virtual math teams with software conversational agents. *First North American GeoGebra Conference.* Ithaca, NY.

Stake, E. (2010). *Qualitative Research: Studying How Things Work*. Guilford Publications.

Stalnaker, C. (1978). Assertion. In Cole, P. (Eds.). *Pragmatics: Syntax and Semantics*. Volume 9, pp.315–332. New York: Academic Press.

Stalnaker, R. (2004). Assertion Revisited: On the Interpretation of Two-dimensional Modal Semantics. *Philosophical Studies* 118: 299–322. Stanley, Jason.

Stangor, C. (2014). *Research Methods for the Behavioral Sciences*. Cengage Learning.

Stansfield, M. (2009). *Institutional Transformation through Best Practices in Virtual Campus Development: Advancing E-Learning Policies: Advancing E-Learning Policies.* Information Science Reference

Stavropoulou, P., Spiliotopoulos, D. & Kouroupetroglou, G. (2011). Design and Development of an Automated Voice Agent: Theory and Practice Brought Together. In Perez-Marin, D. (Eds.). *Conversational Agents and Natural Language Interaction: Techniques and Effective Practices: Techniques and Effective Practices.* Information Science Reference.

Stegmann, K., Weinberger, A. & Fischer, F. (2007). Facilitating argumentative knowledge construction with computer-supported collaboration scripts. *International Journal of Computer-Supported Collaborative Learning,* 2(4), 421-44.

Stent, A. & Bangalore, S. (2014). *Natural Language Generation in Interactive Systems.* Cambridge University Press.

Stein, A., Gulla, J. & Thiel, U. (1999). User-Tailored Planning of Mixed Initiative Information-Seeking dialogues. In Haller, S., Mcroy, S. & Kobsa, A. (Eds.). *Computational Models of Mixed-Initiative Interaction*. Springer.

Stein, L. & Miller, A. (1991). I win-you lose: The development of argumentive thinking. In Voss, J., Perkins, N. & Segal, W. (Eds.). Informal reasoning and education. (pp.265–290). Taylor & Francis.

Stein, S. & Farmer, S. (2004). *Connotative Learning: The Trainer's Guide to Learning Theories and Their Practical Application to Training Design*. IACET/Kendall/Hunt Pub.

Stephanidis, C. (2009). *The Universal Access Handbook*. CRC Press.

Stephens, R. (2007). *Expert One-on-One Visual Basic 2005 Design and Development*. Wiley.

Sternberg, R. (2005). *Cognitive Psychology*. Cengage Learning.

Sternberg, R. (1986).Critical thinking: Its nature measurement, and improvement. *National Institute of Education*.

Sternberg, R. (2013). *Thinking and Problem Solving*. Elsevier Science.

Sternberg, R., Roediger, L. & Halpern, D. (2006). *Critical Thinking in Psychology*. (1st Edition). Cambridge University Press.

Stotz, D. (1991). *Verbal Interaction in Small-group Activities: A Process Study of an English Language Learning Classroom*. G. Narr.

Strauss, A. & Corbin, J. (1998). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*. (2nd Edition). London: SAGE.

Strauss, M. & Minker, W. (2010). *Proactive Spoken Dialogue Interaction in Multi-Party Environments*. Springer US.

Strobelberger, K. (2011). *A comparison of classroom discourse in two countries.* Diplom.de.

Strongman, L. (2014). *Academic Writing.* Cambridge Scholars Publisher.

Stubbs, M. (1983) *Discourse Analysis: the sociolinguistic analysis of natural language*. Oxford, Blackwell.

Suchman, L. (2007). *Human-Machine Reconfigurations: Plans and Situated Actions*. Cambridge University Press.

Sullivan, H. (2013). *Cases on Professional Distance Education Degree Programs and Practices: Successes, Challenges, and Issues: Successes, Challenges, and Issues*. IGI Global.

Surie, D., Pederson, T. & Janlert, L. (2012). Human Cognition as a foundation for the Emerging Egocentric Interaction Paradigm. In Zacarias, M. & De Oliveira, V. (Eds.). *Human-Computer Interaction: The Agency Perspective*. Berlin Heidelberg: Springer.

Suthers, D., Lund, K., Penstein, R., Teplovs, C. & Law, N. (2013). *Productive Multivocality in the Analysis of Group Interactions.* Springer US.

Swan, K., Garrsion, D. & Richardson, J. (2009). A Constructivist Approach to Online Learning: The Community of Inquiry Framework. In Payne, R. (Eds.). *Information Technology and Constructivism in Higher Education: Progressive Learning Frameworks: Progressive Learning Frameworks.* Information Science Reference.

Swatridge, C. (2014). *Oxford Guide to Effective Argument and Critical Thinking.* Oxford University Press.

Syrdal, A., Bennett, R. & Greenspan, S. (1994). *Applied Speech Technology*. Taylor & Francis.

Szczerbicki, E. & Nguyen, N. (2009). *Smart Information and Knowledge Management: Advances, Challenges, and Critical Issues.* Springer.

Tan, G. (2012). *Creativity, Talent and Excellence*. Springer Singapore.

Tan, S. & Nijholt, A. (2010). *Brain-Computer Interfaces: Applying our Minds to Human-Computer Interaction*. Springer.

Tanner, R. & Amato, T. (2012). Building Virtual Communities: Can We Talk? In Kelsey, S. & Amant, S. (Eds.). *Computer Mediated Communication: Issues and Approaches in Education*. Information Science Reference.

Tarricone, P. (2011). *The Taxonomy of Metacognition*. Taylor & Francis.

Taylor, M., Néel, F. & Bouwhuis, G. (2000). T*he Structure of Multimodal Dialogue II.* John Benjamins Publishing Company.

Tegos, S., Karakostas, A. & Demetriadis, S. (2014). Conversational Agents for Learning: How the Agent Role Affects Student Communication. In Karagiannidis, C., Politis, P. & Karasavvidis, I. (Eds.). *Research on e-Learning and ICT in Education: Technological, Pedagogical and Instructional Perspectives* New York: Springer.

Thatchenkery, T. (2009). *Appreciative Intelligence: Seeing the Mighty Oak in the Acorn.* ReadHowYouWant.com, Limited.

Thayer-Bacon, J. (2000). *Transforming Critical Thinking: Thinking Constructively*. Teachers College Press.

Thomas, G. (2010). *How to do your Case Study: A Guide for Students and Researchers*. SAGE Publications.

Thomas, M. (1998). *Conducting Educational Research: A Comparative View*. Bergin and Garvey.

Thurlow, C., Lengel, L. & Tomic, A. (2004). *Computer Mediated Communication*. SAGE Publications.

Tindale, W. (1999). *Acts of Arguing: A Rhetorical Model of Argument*. State University of New York Press.

Tishman, S. & Andrade, A. (1995). *Thinking dispositions: A review of current theories, practices, and issues. Report 1*. Washington, DC: ACCTION.

Tittle, P. (2011). *Critical Thinking: An Appeal to Reason*. Taylor & Francis.

Tomei, A. (2008). *Information Communication Technologies for Enhanced Education and Learning: Advanced Applications and Developments: Advanced Applications and Developments.* Information Science Reference.

Tomei, A. (2010). *Online Courses and ICT in Education: Emerging Practices and Applications: Emerging Practices and Applications*. Information Science Reference.

Toulmin, S. (1958). *The uses of argument*. Cambridge, UK: Cambridge University Press

Tracy, J. (2012). *Qualitative Research Methods: Collecting Evidence, Crafting Analysis, Communicating Impact*. Wiley.

Traum, D., Swartout, W., Gratch, J. & Marsella, S. (2008). A Virtual Human Dialogue Model For Non-Team Interaction. In Dybkjær, L. & Minker, W. (Eds.). *Recent Trends in Discourse and Dialogue*. Springer Netherlands

Tsui, A. (1994). *English Conversation*. Oxford: Oxford University Press

Tuckett, A. (2004). Qualitative research sampling-the very real complexities. *Nurse Researcher*, 12(1): 47-61.

Tuckman, B. & Monetti, D. (2010). *Educational Psychology*. Cengage Learning.

Utts, J. & Heckard, R. (2005). *Statistical Ideas and Methods.* Cengage Learning.

Valverdu, J. (2014). Qualia Learning? Innerbodiment Construction and Machine Self-Learning (Emotional) Imitation. In Vallverdú, J. (Eds.). *Handbook of Research on Synthesizing Human Emotion in Intelligent Systems and Robotics.* IGI Global.

Van Blerkom, L. (2013). *Orientation to College Learning*. Cengage Learning.

Van Den, J., Gravemeijer, K., Mckenney, S. & Nieveen, N. (2006). *Educational Design Research*. Taylor & Francis.

Van Dijk, A. (2010). *Discourse and Context: A Sociocognitive Approach*. Cambridge University Press.

Van Eemeren, F. (1987). *Argumentation: Perspectives and Approaches*. Foris.

Van Eemeren, F. (2001). *Crucial Concepts in Argumentation Theory*. Amsterdam University Press.

Van Eemeren, F. (2009). *Pondering on Problems of Argumentation: Twenty Essays on Theoretical Issues*. Springer Netherlands.

Van Eemeren, F. (2015). *Reasonableness and Effectiveness in Argumentative Discourse: Fifty Contributions to the Development of Pragma-Dialectics.* Springer International Publishing.

Van Eemeren, F. & Grootendorst, R. (1984). *Speech Acts in Argumentative Discussions: A Theoretical Model for the Analysis of Discussions Directed Towards Solving Conflicts of Opinion*. Foris Publications.

Van Eemeren, F. & Grootendorst, R. (1999). Developments in argumentation theory. In Andriessen, J. & Coirier, P. (Eds.). *Foundations of argumentative text processing*. Amsterdam: Amsterdam University Press.

Van Eemeren, F. & Grootendorst, R. (2004). *A Systematic Theory of Argumentation: The Pragma-dialectical Approach*. Cambridge University Press.

Van Eemeren, F., Grootendorst, R. & Henkemans, S. (2002). *Argumentation: Analysis, Evaluation, Presentation*. Taylor & Francis.

Van Eemeren, F., Grootendorst, R., Johnson, H., Plantin, C. & Willard, A. (2013). *Fundamentals of Argumentation Theory: A Handbook of Historical Backgrounds and Contemporary Developments*. Taylor & Francis.

Van Eemeren, F & Houtlosser, P. (2009). Strategic manoeuvring: Examining argumentation in context. In Van Eemeren, F. (Eds.). *Examining Argumentation in Context: Fifteen Studies on Strategic Manoeuvering*. John Benjamins Publishing Company.

Van Eemeren, F. & Houtlosser, P. (2013). *Dialectic and Rhetoric: The Warp and Woof of Argumentation Analysis.* Springer Netherlands.

Van Eemeren, F., Houtlosser, P. & Henkemans, S. (2007). *Argumentative Indicators in Discourse: A Pragma-Dialectical Study*. Springer Netherlands.

Van Eemeren, F. & Meuffels, B. (2009). *Fallacies and Judgments of Reasonableness: Empirical Research Concerning the Pragma-Dialectical Discussion Rules*. Springer Netherlands.

Van Straalen, B., Heylen, D., Theune, M. & Nijholt, A. (2009). Enhancing embodied conversational agents with social and emotional capabilities. In Dignum, F., Bradshaw, J., Silverman, B. &Van

Doesburg, W. (Eds.) *Agents for Games and Simulations. Lecture Notes in Computer Science,* Vol. 5920, pp.95-106. Berlin: Springer Verlag.

Vandergriff, I. (2010). Humor and Play in CMC. In Taiwo, R. (Eds.). Handbook of *Research on Discourse Behavior and Digital Communication: Language Structures and Social Interaction: Language Structures and Social Interaction.* Information Science Reference.

Vandenbergen, M., Taverniers, M. & Ravelli, L. (2003). *Grammatical Metaphor: Views from Systemic Functional Linguistics*. Benjamins Publishing Company.

Vass, E. & Littleton, K.(2010). Peer Collaboration and Learning in the Classroom. In Littleton, K., Wood, P. & Staarman, K. (Eds.). *International Handbook of Psychology in Education.* Emerald.

Veerman, L., Andriessen, B. & Kanselaar, G. (2002). Collaborative argumentation in academic education. *Instructional Science*. 30(3), 155–186.

Verbeek, P. & Slob, A. (2006). *User Behavior and Technology Development: Shaping Sustainable Relations Between Consumers and Technologies*. Springer Netherlands.

Vermeulen, I., Roth, C., Vordered, P. & Klimmt, C. (2010). Measuring User Responses to Interactive Stories: Towards a standardized Assessment Tool. In Aylett, R., Lim, Y., Louchart, S., Petta, P. & Riedl, M. (Eds.). *Interactive Storytelling: Third Joint Conference on Interactive Digital Storytelling, ICIDS 2010, Edinburgh, UK, November 1-3, 2010, Proceedings*. Springer.

Vogt, P., Gardner, C. & Haeffele, M. (2012). *When to Use What Research Design*. Guilford Publications.

Vogt, P., Gardner, C., Vogt, R. & Haeffele, M. (2014). *Selecting the Right Analyses for Your Data: Quantitative, Qualitative, and Mixed Methods.* Guilford Publications.

Vonderwell, S. (2003). An examination of asynchronous communication experiences and perspectives of students in an online course: A case study. *Internet and Higher Education,* 6, 77-90.

Voss, J. & Dyke. V. (2001). Argumentation in Psychology: Background Comments. *Discourse Processes,* 32:2-3, 89-111

Vygotsky, L. (1978). Interaction between learning and development. In Gaivain, M. & Cole, M. (Eds.). *Mind and. Society*. (pp.79-91). Cambridge, MA: Harvard University Press.

Vyncke, M. (2012). *The Concept and Practice of Critical Thinking in Academic Writing: An Investigation of International Students' Perceptions and Writing Experiences*. MA thesis. King's College London.

Wade, C. (2009). Critical Thinking: Needed Now More Than Ever 11. In Dunn, S., Halonen, S. & Smith, A. (Eds.). *Teaching Critical Thinking in Psychology: A Handbook of Best Practices.* Wiley.

Wagner, M. (2006). *First Steps to Communication: A Pragmatic Analysis*. Narr.

Wahlster, W. (2006). *SmartKom: Foundations of Multimodal Dialogue Systems.* Berlin Heidelberg: Springer.

Waicukauski, J., Sandler, M. & Epps, A. (2009). *The 12 Secrets of Persuasive Argument.* American Bar Association.

Walker, A., Passonneau, R. & Boland, E. (2001).Quantitative and qualitative evaluation of DARPA Communicator spoken dialogue systems. *Proceedings of 39th Annual Meeting of the Association for Computational Linguistics, Association for Computational Linguistics, Toulouse, France,* p.515-522.

Walker, A. (2003). *The Contribution of Computer-Mediated Communication In Developing Argument Skills And Writing-Related Self-Esteem*. Unpublished PhD thesis. School of Education. University of Leeds.

Walker, A. (2004). Socratic Strategies and Devil's Advocacy in Synchronous CMC Debate. *Journal of Computer Assisted Learning,* 20(3): 172–182.

Walker, A. & White, G. (2013). *Oxford Handbooks for Language Teachers: Technology Enhanced Language Learning*. Oxford University Press.

Walker, E., Rummel, N. & Koedinger, R. (2011). Designing automated adaptive support to improve student helping behaviors in a peer tutoring activity. *International Journal of Computer-Supported Collaborative Learning, 6* (2), 279–306.

Wallace, P. & Van Fleet, J. (2012). *Knowledge into Action: Research and Evaluation in Library and Information Science.* ABC-CLIO.

Wallace, R. (2003). The Elements of AIML Style. A.L.I.C.E. *Artificial Intelligence Foundation*, Inc.

Wallace, R., Tomabechi, H. & Aimless, D. (2003). *Chatterbots go native: Considerations for an eco-system fostering the development of artificial life forms in a human world*. [Online] Available at: http://www.pandorabots.com/pandora/pics/chatterbotsgonative.doc. [Accessed 01/01/2016].

Walsh, S. (2006). *Investigating Classroom Discourse*. Taylor & Francis.

Walsh, S. (2011). *Exploring Classroom Discourse: Language in Action*. Taylor & Francis.

Walsh, S. (2013). *Classroom Discourse and Teacher Development.* Edinburgh University Press.

Walton, D. (1984). *Logical Dialogue Games and Fallacies*. University Press of America.

Walton, D. (1991). *Begging the Question: Circular Reasoning as a Tactic of Argumentation*. Greenwood Press.

Walton, D. (1997). *Appeal to Pity: Argumentum ad Misericordiam*. State University of New York Press.

Walton, D. (1998). *The New Dialectic: Conversational Contexts of Argument*. University of Toronto Press.

Walton, D. (1992). *Plausible Argument in Everyday Conversation.* State University of New York Press.

Walton, D. (1999). *One-Sided Arguments: A Dialectical Analysis of Bias*. State University of New York Press.

Walton, D. (2003). *Ethical Argumentation*. Lexington Books.

Walton, D. (2004). *Relevance in Argumentation*. Lawrence Erlbaum Assoc Incorporated.

Walton, D. (2005). *Argumentation Methods for Artificial Intelligence in Law*. Berlin Heidelberg: Springer.

Walton, D. (2006). *Fundamentals of Critical Argumentation*. Cambridge University Press.

Walton, D. (2007). *Dialog Theory for Critical Argumentation*. John Benjamins Pub.

Walton, D. (2009). Argumentation Theory: A very short Introduction. In Rahwan, I. (Eds.). *Argumentation in Artificial Intelligence*. Springer US.

Walton, D. (2010a). *Appeal to Popular Opinion.* Pennsylvania State University Press.

Walton, D. (2010b). *The Place of Emotion in Argument.* Pennsylvania State University Press.

Walton, D. (2010c) Types of Dialogue and Burdens of Proof. In Baroni, P., Cerutti, F., Giacomin, M. & Simari, R. (Eds.). *Computational Models of Argument: Proceedings of COMMA 2010.* IOS Press.

Walton, D. (2013a). *Argumentation Schemes for Presumptive Reasoning*. Taylor & Francis.

Walton, D. (2013b). *Methods of Argumentation*. Cambridge University Press.

Walton, D. (2014). *Burden of Proof, Presumption and Argumentation.* Cambridge University Press.

Walton, D. (2015a). *Argument Evaluation and Evidence*. Springer International Publishing.

Walton, D. (2015b). *Goal-based Reasoning for Argumentation*. Cambridge University Press.

Walton, D. & Krabbe, W. (1995). *Commitment in Dialogue: Basic Concepts of Interpersonal Reasoning*. State University of New York Press.

Walton, D., Reed, C. & Macagno, F. (2008). *Argumentation Schemes*. Cambridge University Press.

Walton, D. & Reed, C. (2002). Diagramming, Argumentation Schemes and Critical Questions. *The 5th International Conference on Argumentation (ISSA'2002), SicSat, Proceedings, Amsterdam,* pp.881-885.

Wang, L. (2013). *Dynamic Thermal Analysis of Machines in Running State.* London: Springer.

Wang, M. (2004). Taking online courses in the United States: The perspectives of Asian students from China, Korea, Singapore, and Taiwan. In Nall, J. & Robson, R. (Eds.). *World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2004*. Washington, DC, USA: AACE.

Wang, X, & Nakatsu, R. (2013). How do People Talk with a Virtual Philosopher: Log Analysis of Real-World Application. In Anacleto, C., Clua, G., Da Silva, C., Fels, S. & Yang, S. (2013). *Entertainment Computing -- ICEC 2013: 12th International Conference, ICEC 2013, São Paulo, Brazil, October 16-18, 2013, Proceedings.* Berlin Heidelberg: Springer.

Warnick, B. & Inch, S. (1989). *Critical thinking and communication: the use of reason in argument.* Macmillan Publishing Company.

Warschauer, M. (1996a). Comparing face-to-face and electronic discussion in the second language classroom. *CALICO Journal*, 13 (2), 7-26.

Warschauer, M. (1996b). Motivational aspects of using computers for writing and communication. In Warschauer, M. (Eds.), *Telecollaboration in foreign language learning: Proceedings of the Hawai'i symposium. (Technical Report 12)*, pp.29–46. Honolulu, Hawai'i: University of Hawai'i, Second Language Teaching & Curriculum Center.

Warschauer, M. & Kern, G. (2000). *Network-based Language Teaching: Concepts and Practice.* Cambridge University Press.

Waschull, B. (2001). The online delivery of psychology courses: Attribution, performance, and evaluation. *Teaching of Psychology*, 28, 143–147.

Wash, A. (2012). Computer-mediated communication as an autonomy-enhancement tool for advanced learners of English. *Studies in Second Language Learning and Teaching.* SSLLT 2 (3). 367-389.

Watson, R., Mckenna, H., Cowman, S. & Keady, J. (2008). *Nursing Research: Designs and Methods.* Elsevier Health Sciences UK.

Watts, N. (2010). Reflecting on models for online learning in theory & practice. *Journal of Teaching and Learning in Higher Education (AISHE-J)*, 2(1), p 19.1 - 19.12.

Webb, N., Bradley, J., Hansen, P. & Mival, O. (2010). Wizard of oz experiments for a companion dialogue system: Eliciting companionable conversation. *In Proceedings of the Seventh conference on International Language Resources and Evaluation* (LREC'10). European Language Resources Association (ELRA).

Weegar, M. & Pacis, D. (2012*)*. A Comparison of two theories of learning-behaviorism and constructivism as applied to face-to-face and online learning. *E-Leader Manila*.

Wegerif, R. (2006). A dialogic understanding of the relationship between CSCL and teaching thinking skills. *International Journal of Computer Supported Collaborative Learning* 1(1), 143-157.

Wegerif, R. (2007). *Dialogic Education and Technology: Expanding the Space of Learning*. Springer.

Wegerif, R. (2013). *Dialogic: Education for the Internet Age*. Routledge.

Wegerif, R. & Mercer, N. (1997). A Dialogical Framework for Investigating Talk. In Wegerif, R. & Scrimshaw, P. (Eds.). *Computers and Talk in the Primary Classroom*, pp 49 65. Clevedon: Multilingual Matters.

Weigand, E. (2010). *Dialogue: The Mixed Game*. John Benjamins Publishing Company.

Weinstein, M. (1990). Towards a research agenda for informal logic and critical thinking. *Informal logic*, 12(3).

Weiss, H. & Weiss, M. (2013). *Making Arguments: Reason in Context, Archieboy Holdings*. LLC.

Weizenbaum, J. (1966). ELIZA-A computer program for the study of natural language communication between man and machine. *Communications of the ACM*, 9(1), 36-35.

Wengraf, T. (2001). *Qualitative Research Interviewing: Biographic Narrative and Semi-Structured Methods.* SAGE Publications.

Wenke, D. & Frensch, P. (2003). Is Success or Failure at Solving Complex Problem Related to Intellectual Ability? In Davidson, E. & Sternberg, J. (Eds.). *The Psychology of Problem Solving*. Cambridge University Press.

Wertsch, V. (1991). *Voices of the mind*. New York: Harvester.

Wheeldon, L. (2013). *Aspects of Language Production*. Taylor & Francis.

Whittaker, S., Walker, M. & Moore., J. (2002). Fish or Fowl: A Wizard of Oz evaluation of dialogue strategies in the restaurant domain. *In Proc. of the International Conference on Language Resources and Evaluation (LREC).*

Wilkinson, D. & Birmingham, P. (2003). *Using Research Instruments: A Guide for Researchers.* RoutledgeFalmer.

Williams, J. (1981). Inconsistency and Contradiction.Vol xc *Mind* 90, 600–602.

Williams, R. (2004). *Developing Performance Support for Computer Systems: A Strategy for Maximizing Usability and Learnability*. CRC Press.

Willig, C. (2013). *Introducing Qualitative Research In Psychology*. Open University Press.

Willingham, T. (2007). Critical thinking: Why is it so hard to teach? *American Educator*, 8–19.

Wilson, D. & Allen, D. (2011). Success rates of online versus traditional college student. *Research in Higher Education Journal.*

Wilson, D. & Sperber, D. (2012). *Meaning and Relevance*. Cambridge University Press.

Wingate, U. (2012). Argument!' helping students understand what essay writing is about. *Journal of English for Academic Purposes,* (11) 145-154

Wisdom, S. (2015). *Handbook of Research on Advancing Critical Thinking in Higher Education*. IGI Global.

Wishart, C. & Guy, R. (2009). Analyzing responses, moves, and roles in online discussions. *Interdisciplinary Journal of E-Learning and Learning Objects* 5, 129-144.

Witczak-Plisiecka, I. (2013). *Pragmatic Perspectives on Language and Linguistics Volume II: Pragmatics of Semantically-Restricted Domains*. Cambridge Scholars Publisher.

Wodak, R., Krzyżanowski, M., Abell, J., Gruber, H., Mautner, G. & Myers, G. (2008). *Qualitative Discourse Analysis in the Social Sciences*. Palgrave Macmillan.

Wolska, M. & Buckley, M. (2008). A taxonomy of task-related dialogue actions: the cases of tutorial and collaborative planning dialogue. In Storrer, A., Geyken, A., Siebert, A. & Würzner, M. (Eds.). *Text Resources and Lexical Knowledge: Selected Papers from the 9th Conference on Natural Language Processing KONVENS 2008.* De Gruyter.

Wong, L. (2011). *Essential Study Skills*. Cengage Learning.

Wood, A. & Kroger, O. (2000). *Doing Discourse Analysis: Methods for Studying Action in Talk and Text.* SAGE Publications.

Woodrow, G. (2014). *The Pyramid Approach: A Framework for Raising Student Academic Achievement.* Rowman & Littlefield Publishers.

Wooffitt, R. (2005). *Conversation Analysis and Discourse Analysis: A Comparative and Critical Introduction.* SAGE Publications.

Woolf, P. (2010). *Building Intelligent Interactive Tutors: Student-centered strategies for revolutionizing e-learning*. Elsevier Science.

Woolfolk, A. (2005). *Educational psychology: Active learning edition*. Pearson/Allyn and Bacon Publishers.

Wootton, S. (2010). *Strategic Thinking: A Step-by-step Approach to Strategy and Leadership*. Kogan Page.

Woudenberg, V. (2014). A Chatbot Dialogue Manager: Chatbots and Dialogue Systems: A Hybrid Approach. *Faculty of Management, Science and Technology. Open University of the Netherlands*.

Wright, M. & Webb, M. (2011). *Computer-mediated Communication in Personal Relationships*. Peter Lang.

Xuan, W. (2013). *Interacting With Philosophy Through Natural Language Conversation*. Unpublished PhD thesis. National University of Singapore.

Yaghoubzadeh, R., Kramer, M., Pitsch, K. & Kopp, S. (2013).Virtual Agent as Daily Assistants for Elderly or Cognitive impaired People: Studies on Acceptance and Interaction Feasibility. In Aylett, R., Krenn, B., Pelachaud, C. & Shimodaira, H. (Eds.). *Intelligent Virtual Agents: 13th International Conference, IVA 2013, Edinburgh, UK, August 29-31, 2013, Proceedings.* Berlin Heidelberg: Springer.

Yang, H. (2012). *Cases on Online Learning Communities and Beyond: Investigations and Applications: Investigations and Applications*. Information Science Reference.

Yin, R. (2009). *Case Study Research: Design and Methods*. SAGE Publications.

Yin, R. (2011). *Qualitative Research from Start to Finish.* (1st Edition). Guilford Publications.

Yin R. (2012). *Applications of Case Study Research*. SAGE Publications.

Yin, R. (2015). *Qualitative Research from Start to Finish*. Guilford Publications.

Yodkamlue, B. & Carolina, S. (2008). *Online Texts of Non-native Speakers in an L2 Electronic Discussion Forum: An Analysis of Social Presence and Cognitive Presence.* University of South Carolina.

Yoon, W. (2006). Two group development patterns of virtual learning teams: Linear progression and adaptive progression. *Quarterly Review of Distance Education*, Volume 7.

York, C., Yang, D. & Dark, M. (2008). Transitioning from Face-to-Face to Online Instruction: How to Increase Presence and Cognitive/Social Interaction in an Online Information Security Risk Assessment Class. In Van Slyke, C. (Eds.). *Information Communication Technologies: Concepts, Methodologies, Tools, and Applications: Concepts, Methodologies, Tools, and Applications*. Information Science Reference.

Yuan, T., Moore, D. & Grierson, A. (2002). *Educational Human-Computer Debate, a Computational Dialectics Approach. In Proceedings of ECAI'2002 Workshop on Computational Models of Natural Argument.* pp.19-22.

Yule, G. (2014). *The Study of Language*. Cambridge University Press.

Yuzer, V. (2014). *Handbook of Research on Emerging Priorities and Trends in Distance Education: Communication, Pedagogy, and Technology: Communication, Pedagogy, and Technology*. IGI Global.

Zaborowski, A. & Pittsburgh, O. (2008). *Identifying the Information-seeking Behaviors of Students, the Expectations of Faculty, and the Role of Librarians in Writing Assignments that Require Students to Use Information Sources in Selected Pennsylvania Community Colleges: A Model for Instruction*. Unpublished PhD thesis. University of Pittsburgh.

Zacarias, M. & De Oliveira, V. (2012). *Human-Computer Interaction: The Agency Perspective*. Berlin Heidelberg: Springer.

Zadronzy, W., Budzikowska, M., Chai, J., Kambtalta, N., Levedque, S. & Nicolov, N. (2000). Natural language dialogue for personalized interaction. *Communications of the ACM, 43,* pp.116 – 120.

Zaferanieh, E. (2012). Conversation Analysis of Online Chat, The First Conference on Language Learning & Teaching: An Interdisciplinary Approach, October 30 - 31, 2012. *Department of English, Mashhad Branch, Islamic Azad University*.

Zahner, C., Fauverge, A. & Wong, J. (2000). Task-based language learning via audiovisual networks: the LEVERAGE project. In Warschauwer, M. & Kern, R. (Eds.). *Network-based language teaching: concepts and practice*. Cambridge University Press.

Zakaria, E. & Iksan, Z. (2007). Promoting Cooperative Learning in Science and Mathematics Education: A Malaysian perspective. Eurasia. *Journal of Mathematics, Science & Technology Education,* 3(1), 35-39.

Zakos J. & Capper, L. (2008). CLIVE - An Artificially Intelligent Chat Robot for Conversational Language Practice. Darzentas, J. (Eds.). *Artificial Intelligence: Theories, Models and Applications: 5th Hellenic Conference on AI, SETN 2008, Syros, Greece, October 2-4, 2008, Proceedings.* Springer.

Zarefsky, D. (2014). *Rhetorical Perspectives on Argumentation*. Springer International Publishing.

Zhang, B., Hu, C., Cia, B., Guo. H. & Shum, Y. (2003). E-partner: A photo-Realistic Conversational agent. In Shum, Y., Liao, M. & Chang, F. (Eds.). *Advances in Multimedia Information Processing — PCM 2001: Second IEEE Pacific Rim Conference on Multimedia Beijing, China, October 24–26, 2001 Proceedings.* Berlin Heidelberg: Springer.

Zhang, X., Liu, J., Liu, C. & Cole, M. (2014). Factors Influencing Users' Perceived Learning During Online Searching. In Rodriguez, S. & Yáñez, T. (2014). *ICEL2104-Proceedings of the 9th International Conference on e-Learning: ICEL 2014.* Academic Conferences and Publishing International Limited.

Zhang, Z. & Kenny, R. (2010). Learning in an online distance education course: Experiences of three international students. *The International Review of Research in Open and Distance Learning,* 11 (1) (2010).

Zirbel, L. (2006). Teaching to promote deep understanding and instigate conceptual change. *Bulletin of the American Astronomical Society*, 38, 1220.

Zohar, A. & Dori, J. (2011). *Metacognition in Science Education: Trends in Current Research*. Springer Netherlands.

Appendix A: Consent Form- School of Education-University of Leeds

Dear Head of the School of Education, University of Leeds

I am writing to you to inform you of my intention to conduct my PhD research project at the School of Education at the University of Leeds. The research will be carried out with MA students enrolled in MA ICT/ELT in Education.

Research Title:

‘‘Designing a conversational agent to support critical thinking and academic argumentation skills”

The research aims to create a conversational agent that could support critical thinking and academic argumentation skills. Conversational agents, or chatbots, are computer programs that help users to interact with computers and engage in dialogues using natural language. The study is expected to contribute to our understanding of the processes and challenges of creating conversational agents for the purpose of enhancing academic argumentation skills.

I have been informed of the purpose for the research. I hereby give my consent for **Abdulqader Alharbi** to conduct his research study at the School of Education at the University of Leeds. I have been informed and understand that:

- All data collected will be kept secure and private
- The identities of the research participants will remain anonymous
- The data collection procedures will include students’ online chats analysis and interviews
- Students’ informed consent forms will be provided before the students take part in this study
- Anonymised data and findings from this study may be presented at conferences and/or included in academic publications

Signed ____

Dated ____

Researcher & PhD Student: Abdulqader Alharbi (University of Leeds, UK)

Supervisors: Dr Aisha Walker and Dr James Simpson (University of Leeds, UK)

For more information please contact the researcher at ml09a3ha@leeds.ac.uk

Thanks for your invaluable time and collaboration.

Appendix B: Information letter- Student-Stage one

Dear participant,

I would like to invite you to take part in my PhD research project. Please spend a few minutes reading this information in order to understand the reason for conducting this research, which may help you to make a decision about taking part. Anonymised data and findings from this study may be presented at conferences and/or included in academic publications.

Research Title:

''Designing a conversational agent to support critical thinking and academic argumentation skills"

The research aims to create a conversational agent that could support critical thinking and academic argumentation skills. Conversational agents, or chatbots, are computer programs that help users to interact with computers and engage in dialogues using natural language. The study is expected to contribute to our understanding of the processes and challenges of creating conversational agents for the purpose of enhancing academic argumentation skills.

If you decide to participate in the study, I would like to inform you that:

- Your participation is entirely voluntary and refusing to take part in the study will not adversely affect your studies. In addition, participation in this research will not contribute towards your success or otherwise of the module.
- If you agree to participate voluntarily, will be asked to return the completed informed consent forms directly to my email: ml09a3ha@leeds.ac.uk.
- You have the right to withdraw from this research at any stage without giving any reason. This will not affect any benefits that you are entitled to in any way.
- If you decided to withdraw, the data you give prior to withdrawing will be removed from the study.
- In the event of your withdrawal from the study, you can request that your data to be deleted and destroyed.
- I will analyse your contributions in online seminars after replacing your names with pseudonyms, and your provided information will be kept safe.
- I will protect your identity and the collected data will be totally confidential
- All information will be utilized only for the benefit of this research.

If you require any further information or explanation, please email me at the following address: ml09a3ha@leeds.ac.uk

Yours sincerely,

Abdulqader Alharbi

Appendix C: Consent form- Student-Stage one

‘‘Designing a conversational agent to support critical thinking and academic argumentation skills”

I confirm that,

1. I have read the information sheet of this study and have had the details of the study explained to me.
2. My questions about the study have been answered to my satisfaction, and I understand that I may ask further questions at any time.
3. I understand that participation in the study is totally voluntary, and refusing to take part in the study will not adversely affect my studies.
4. I am aware that participation in the study will not contribute towards my success or otherwise of the module.
5. I understand that I am free to withdraw from the study at any time, or to decline to answer any particular questions in the study.
6. I understand that in the event of my withdrawal from the study, I can request for my data to be deleted.
7. I agree to provide information to the researchers under the conditions of confidentiality set out on the information sheet.
8. I wish to participate in this study under the conditions set out in the Information Sheet.
9. I agree to the analysis of my contributions on online seminars after my name has been replaced with a pseudonym.

Please type your name: ____

Date: ____

Researcher & PhD Student: Abdulqader hamid alharbi (University of Leeds, UK)

Supervisors: Dr Aisha Walker and Dr James Simpson (University of Leeds, UK)

For more information please contact the researcher at ml09a3ha@leeds.ac.uk

Thanks for your invaluable time and collaboration.

Appendix D: Information letter- Student-Stage two

Dear participant,

I would like to invite you to take part in my PhD research project. Please spend a few minutes reading this information in order to understand the reason for conducting this research, which may help you to make a decision about taking part. Anonymised data and findings from this study may be presented at conferences and/or included in academic publications.

Research Title:

‘‘Designing a conversational agent to support critical thinking and academic argumentation skills”

The research aims to create a conversational agent that could support critical thinking and academic argumentation skills. Conversational agents, or chatbots, are computer programs that help users to interact with computers and engage in dialogues using natural language. The study is expected to contribute to our understanding of the processes and challenges of creating conversational agents for the purpose of enhancing academic argumentation skills.

If you decide to participate in the study, I would like to inform you that:

- If you agree to participate, will be asked to return the completed informed consent forms directly to my email: ml09a3ha@leeds.ac.uk.
- You have the right to withdraw from this research at any stage without giving any reason. This will not affect any benefits that you are entitled to in any way.
- If you decided to withdraw, the data you give prior to withdrawing will be removed from the study.
- In the event of your withdrawal from the study, you can request for your data to be deleted and destroyed.
- I will analyse your chat with the conversational agent after replacing your name with a pseudonym.
- I will protect your identity and the collected data will be totally confidential
- The interview is unlikely to take more than 30 minutes.
- The interview will be conducted in a place of your choice (for example, your University/Institution, or via Skype).
- Anonymised data and findings from this study may be presented at conferences and/or included in academic publications.

If you require any further information or explanation, please email me at the following address: ml09a3ha@leeds.ac.uk

Yours sincerely,

Abdulqader Alharbi

Appendix E: Consent Form- Student-Stage two

Research Title:

‘‘<u>Designing a conversational agent to support critical thinking and academic argumentation skills”</u>

I confirm that,

1. I have read the information sheet of this study and have had the details of the study explained to me.
2. My questions about the study have been answered to my satisfaction, and I understand that I may ask further questions anytime.
3. I am aware that participation in the study will not contribute towards my success or otherwise of the module.
4. I understand that I am free to withdraw from the study at any time, or to decline to answer any particular questions in the study.
5. I understand that in the event of my withdrawal from the study, I can request for my data to be deleted.
6. I agree to provide information to the researchers under the conditions of confidentiality set out on the information sheet.
7. I wish to participate in this study under the conditions set out in the Information Sheet.
8. I agree to the analysis of my chat with the chatbot (Botocrates) after replacing my name with a pseudonym.
9. I agree to be interviewed after using the chatbot.
10. I agree that anonymised data and findings from this study can be presented at conferences and/or included in academic publications.

Please type your name: ____

Date: ____

Researcher & PhD Student: Abdulqader hamid alharbi (University of Leeds, UK)

Supervisors: Dr Aisha Walker and Dr James Simpson (University of Leeds, UK)

For more information please contact the researcher at ml09a3ha@leeds.ac.uk

Thanks for your invaluable time and collaboration.

Appendix F: Ethical Approval

Performance, Governance and Operations
Research & Innovation Service
Charles Thackrah Building
101 Clarendon Road
Leeds LS2 9LJ Tel: 0113 343 4873
Email: ResearchEthics@leeds.ac.uk

UNIVERSITY OF LEEDS

Abdulqader Alharbi
School of Education
University of Leeds
Leeds, LS2 9JT

ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee
University of Leeds

18 February 2014

Dear Abdulqader

Title of study: **Designing a Chatbot (conversational agent) for promoting critical thinking and academic argumentation skills**
Ethics reference: **AREA 13-057**

I am pleased to inform you that the above research application has been reviewed by the ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee and following receipt of your response to the Committee's initial comments, I can confirm a favourable ethical opinion as of the date of this letter. The following documentation was considered:

Document	*Version*	*Date*
AREA 13-057 Abdul_Ethical_Review_Form_V3.doc	2	03/02/14
AREA 13-057 Committee Provisional and candidate response.docx	1	03/02/14

Please notify the committee if you intend to make any amendments to the original research as submitted at date of this approval, including changes to recruitment methodology. All changes must receive ethical approval prior to implementation. The amendment form is available at http://ris.leeds.ac.uk/EthicsAmendment.

Please note: You are expected to keep a record of all your approved documentation, as well as documents such as sample consent forms, and other documents relating to the study. This should be kept in your study file, which should be readily available for audit purposes. You will be given a two week notice period if your project is to be audited. There is a checklist listing examples of documents to be kept which is available at http://ris.leeds.ac.uk/EthicsAudits.

We welcome feedback on your experience of the ethical review process and suggestions for improvement. Please email any comments to ResearchEthics@leeds.ac.uk.

Yours sincerely

JBlaikie

Jennifer Blaikie
Senior Research Ethics Administrator, Research & Innovation Service
On behalf of Dr Andrew Evans, Chair, AREA Faculty Research Ethics Committee

CC: Student's supervisor(s)