A Mixed-Method Approach to Exploring the Collaborative Practice of Prosody Features in Computer-Assisted Pronunciation Training (CAPT): A Case Study of Algerian Undergraduate EFL Students

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Abstract

Computer-assisted pronunciation training (CAPT) represents an alternative environment for English as a foreign language (EFL) learners to practice pronunciation in a stress-free environment through a self-paced process with immediate and personalized feedback. However, despite emerging evidence on the effectiveness of collaboration with technology, much of the previous research on CAPT has focused on the individual practice employing quantitative measurements that provided learning results yet did not fully explain the learning process. This study, therefore, attempts to explore collaborative CAPT of prosody through a quasi-experimental design employing a mixed-method approach. Such inquiry is especially important in the Algerian EFL classroom where pronunciation instruction focuses mainly on phonemes while prosody features are sidelined due to the lack of teacher training and practice materials. To do this, 18 Algerian adult EFL learners enrolled in pronunciation training sessions once a week for six weeks to practice syllable stress, sentence stress, and intonation using the CAPT system Tell Me More. Participants were randomly assigned to a control group receiving no treatment and two experimental groups, a collaborative CAPT group in which students practiced in pairs, and an individual CAPT group where students practiced individually. Participants' pronunciation output was recorded through read-aloud activities before and after the intervention and analyzed in terms of prosodic quality and overall comprehensibility. The training sessions were video recorded, and participants' perceptions were documented in learning logs and semi-structured interviews, all of which were analyzed thematically. Although the pronunciation learning results did not show significant learning development in participants' prosodic quality and overall comprehensibility, the qualitative results showed a promoted independent and engaging practice environment in collaborative CAPT as opposed to a teacher reliant and monotonous individual CAPT. Such results highlighted the potential advantages and challenges of collaborative CAPT of prosody for EFL teachers interested in integrating this technology.

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Author’s Declaration

I, Moustafa Amrate, declare that this thesis is a presentation of original work and I am the sole author. This work has not previously been presented for an award at this, or any other, University. All sources are acknowledged as References.

Chapter One: General Introduction

The current study aims to explore the collaborative practice of prosody features with computer-assisted pronunciation training (CAPT) through a mixed-method approach. Such an inquiry is especially important in the Algerian EFL classroom where pronunciation instruction is solely focused on phonemic features (consonants and vowels) while prosodic features, despite their equal importance for EFL pronunciation comprehensibility (Munro & Derwing, 1995; Saito, Trofimovich, & Isaacs, 2016), are often neglected due to the lack of teacher training and practice materials (Fethi, 2016; Sonia & Abdelkader Lotfi, 2016b). Today, CAPT technologies come as an alternative stress-free environment to practice prosody features through a self-paced approach with immediate and personalized feedback (Neri, Cucchiarini, Strik, & Boves, 2002; Pennington, 1999). However, unlike research on most computer-assisted language learning (CALL) technologies that has explored the advantages and challenges of collaboration (e.g. Warschauer, 1997; Zhou, Simpson, & Domizi, 2012), research on CAPT remains primarily focused on the effectiveness of individual use (self-access) of such technology through purely quantitative methods that measure pronunciation learning with little attention to the learning process. This first chapter attempts to briefly introduce the background of the study, its theoretical perspective, its methodology, its potential contribution, and finally details the outline of the thesis chapters.

1.1 Background of the Study

EFL university programs in Algeria have recently started to give more attention to pronunciation instruction. In part, and similar to other EFL contexts around the world, this comes as a result of decades of evolution in the attitudes and understanding of pronunciation and its teaching (O'Brien, 2004; Thomson & Derwing, 2014). More importantly, this attention has mainly stemmed from the increasing status of English in the Algerian job market where EFL graduates are expected to have a comprehensible pronunciation as a minimum requirement in jobs where spoken English communication is necessary (e.g. teaching, translation, or journalism) (Belmihoub, 2017; Nadia, 2011). Such a goal of pronunciation instruction is considered to be more realistic and achievable as it measures the quality of EFL learners' pronunciation output by the extent to which the listener finds it difficult to understand rather than comparing it with native speakers' pronunciation as in the nativeness principle (Munro & Derwing, 1995). Under such circumstances, incomprehensible pronunciation can negatively affect the job prospects of Algerian EFL students.

To meet such demands, EFL university programs in Algeria address the pronunciation component through the Phonetics and the Oral Expression modules. However, pronunciation instruction in such modules is largely phonemic where the focus is mainly on the perception and production of consonants and vowels. Meanwhile, prosodic features are often neglected (Fethi, 2016; Sonia & Abdelkader Lotfi, 2016b). This comes in spite of evidence in the pronunciation literature highlighting the equal importance of prosodic features for EFL speech comprehensibility (e.g. Munro & Derwing, 1995; Saito et al., 2016; Sonia & Abdelkader Lotfi, 2016b). When investigating such a lack of focus on prosody features, Fethi (2016) found that most of Algerian EFL teachers at a high school and university levels do not receive specialized training on suprasegmental features. Additionally, most FEL teachers report a lack of materials that help the teachers design and deliver activities that tackle prosody features. In addition to this, and similar to other EFL contexts around the globe, prosodic pronunciation instruction in the Algerian EFL classroom faces a scarcity of prosodic input (Benrabah, 2014), a lack of opportunities for to practice inside and outside the classroom (Melouah, 2013), and feedback on the use of such features is often provided through general comments that fail to highlight the errors for students (Fethi, 2016).

Under such circumstances, CAPT technologies employing automatic speech recognition (ASR) constitute a valuable alternative for Algerian EFL students to practice prosodic features as they provide unlimited input in the target language, self-paced training, and immediate personalized feedback (Neri, Cucchiarini, Strik, et al., 2002; Pennington, 1999). Unlike the traditional classroom, such technologies provide a variety of audio-visual speech models that serve as a reference for EFL students to familiarize themselves with prosodic features (Anderson-Hsieh, 1994; Chun, 1998; Levis, 2007). CAPT technologies also offer a variety of activities that allow EFL students to practice the different prosody features like syllable stress, sentence stress, and intonation with a pace that is primarily determined by the student as the programs offer pause, repeat, and progress options so they can proceed whenever they are satisfied with their output (Khoshsima, Amin, & Moradi, 2017; Neri, Cucchiarini, Strik, et al., 2002; Seferoğlu, 2005). Simultaneously, students practicing with such technology receive instant personalized feedback on their prosodic quality (DeBot, 1983; Hansen, 2006; Hew & Ohki, 2004; Hincks & Edlund, 2009; Neri, Cucchiarini, & Strik, 2008). Such features of ASR based CAPT, if exploited properly, have a lot of potentials in addressing the pronunciation challenges faced by Algerian EFL students especially on a prosodic level.

However, and despite such features, much of the CAPT research has employed a cognitive individualistic approach to investigate the effectiveness of CAPT technology. This line of research, and while it showed the effectiveness of CAPT in developing EFL students'

perception and production of prosody features (Chiu, Liou, & Yeh, 2007; Hardison, 2004; Stenson, Downing, Smith, & Smith, 1992), it has mostly employed an individualistic approach to training with such technology. Moreover, such a trend of CAPT research has mostly employed a quantitative data collection approach where the pronunciation learning results are presented with little detail about the learning process and the contributing factors to such learning. This comes in spite of evidence showing that students face technical, linguistic, and motivational challenges when using such technology on their own (Anderson-Hsieh, 1994; Chiu et al., 2007; Levis, 2007; Tanner & Landon, 2009; Tsai, 2006). Under such individual access mode, EFL students engaged in CAPT of prosody face challenges when trying to navigate the system's user interface (UI), find it difficult to interpret the feedback, and often perceive the training to be repetitive and monotonous.

The current study, therefore, employs a sociocultural perspective in exploring the use of CAPT technology by Algerian EFL students to practice prosody features. Such perspective considers learning as a primarily social activity whereby concepts and, thus, learning are mediated through social interaction using social artifacts such as language, classroom activities, classroom materials and other physical and psychological tools (Vygotsky, 1980). The use of this theory comes in contrast with the cognitive approach which emphasizes the individual mental processes involved in learning while often overlooking the social factors contributing to it. In language education, the sociocultural perspective to learning has been manifested through collaborative activities (Lantolf, 2000). In the current study, such mode of learning is defined not only by the physical setup of having two or more students to work together on a single task with a single CAPT system, but is also defined by students' tendency to share the responsibilities in resolving the task (Roschelle & Teasley, 1995). In computer-assisted language learning (CALL) research, collaboration has been found beneficial in helping students to overcome their technical (Jeon-Ellis, Debski, & Wigglesworth, 2005), linguistic (Beatty, 2013), and psychological challenges (Peiya, 2002) when working with the different language learning technologies. However, despite its potential advantages, only a few studies have addressed collaboration in CAPT.

1.2 The Aim and Research Questions of the Study

The current study aims to explore collaborative CAPT of prosody with Algerian EFL learners. To contribute to a better understanding of the role of collaborative CAPT in the learning of pronunciation and to gain insights into the learning process itself, the study was carried out to investigate the following research questions and sub-questions:

1. To what extent does collaborative CAPT of prosody features enhance Algerian EFL learners' pronunciation learning?

1.1. To what extent does collaborative CAPT of prosody features enhance Algerian EFL learners' **use of prosody features**?

1.2. To what extent does collaborative CAPT of prosody features enhance Algerian EFL learners' **overall pronunciation comprehensibility**?

2. To what extent does collaborative CAPT of prosody influence Algerian EFL students' required guidance to practice in comparison with individual exposure to the technology?

2.1. To what extent does collaborative CAPT of prosody influence **the amount** of Algerian EFL students' required guidance to practice in comparison with individual exposure to the technology?

2.2. To what extent does collaborative CAPT of prosody influence **the type** of Algerian EFL students' required guidance to practice in comparison with individual exposure to the technology?

3. How do Algerian EFL students perceive of collaborative and individual CAPT of prosody features?

3.1. How do Algerian EFL students perceive **the ease of use** of collaborative and individual CAPT of prosody features?

3.2. How do Algeria EFL students perceive **the usefulness** of collaborative and individual CAPT of prosody features?

1.3 Research Methodology

To answer the research questions, 18 adult EFL learners from the University of Biskra in Algeria were recruited to take part in an extra-curricular computer-assisted pronunciation training for six weeks. The sessions took place once a week, each lasting sixty minutes, and focused on three prosody features: syllable stress, sentence stress, and intonation. The training was conducted using the sentence pronunciation activities in the language learning program Tell Me More. Participants were assigned into three groups of six, two experimental groups and one control group. In the first experimental group, the participants used the learning program collaboratively where students accessed a single computer device in pairs. In the second experimental group, the participants used the learning program individually where each student had access to a single computer device. Meanwhile, the participants in the control groups took part only in the pre-test and post-test phases of the study. To collect the data, the current study employed a mixed-method approach addressing both the pronunciation learning development

and the learning process under the two training conditions. To measure EFL students' pronunciation learning, participants took part in audio recorded read-aloud activities that took place before and after the study. The recordings generated from these tests were later analyzed in terms of prosodic quality through expert prosodic coding and rated in terms of overall comprehensibility by nine listeners. On the other hand, the qualitative data involved a camera and screen recording of the training sessions for the purpose of classroom observation. Additionally, learning logs were completed and interviews were conducted to shed light on participants' perceptions towards the training. The pronunciation learning data were then imported into IBM SPSS 24 to generate descriptive statistics, conduct non-parametric tests, and visualize the participants' learning results. Meanwhile, the qualitative data were managed and analyzed through a thematic coding approach using NVivo 11 to generate tables and graphs that highlight the patterns and differences between collaborative and individual CAPT of prosody.

1.4 Contribution of the Study

The current study contributes to a better understanding of ASR based CAPT as an alternative environment to practice prosody with EFL learners on contextual, theoretical, and methodological levels. First of all, the current study sheds light on the potentials of implementing collaborative CAPT as an alternative environment to tackle the limitations facing the teaching and practice of prosody features in the Algerian EFL classroom. While many studies have looked at CAPT in EFL contexts in Asia (e.g. Thomson, 2011; Wang & Munro, 2004), the middle-east (e.g. Al-Qudah, 2012; Elimat & AbuSeileek, 2014), and various European contexts (e.g. Neri, Cucchiarini, et al., 2008), there is a lack of studies investigating the implementation of such technology in the Algerian EFL context where EFL teachers lack the necessary training and materials to deliver lessons and activities focusing on prosody features. Moreover, and while Al-Qudah (2012) and Elimat and AbuSeileek (2014) conducted CAPT studies in a linguistically similar context with Jordanian Arabic EFL speakers, the studies focused primarily on the perception and production of phonemic features. Additionally, the pronunciation needs of EFL learners in Jordan, especially those resulting from L1 transfer, can significantly differ from the needs of Algerian EFL learners due to the dialect variation. This lack of studies on CAPT of prosody with Algerian EFL learners comes in spite of evidence showing the significant correlation between such component of pronunciation and overall EFL speech comprehensibility, especially when considering that this latter pronunciation quality is increasingly required from Algerian EFL learners in the job market (Munro & Derwing, 1995; Saito et al., 2016; Sonia & Abdelkader Lotfi, 2016b). Consequently, the six weeks intervention engaging 18 Algerian EFL learners in CAPT sessions focusing on prosody features represents an important step to address this contextual gap in the CAPT literature.

The current study also contributes to the CAPT literature by exploring the collaborative access to such technology in the practice of prosody features. Overall, most of the research on CAPT of prosody has adopted a cognitive individualistic approach to investigate the effectiveness of CAPT (e.g. Chiu et al., 2007; Hardison, 2004; Stenson et al., 1992; Tanner & Landon, 2009; Tsai, 2006). The implementation of such access mode with CAPT systems remains predominant in spite of evidence showing that EFL students who engage in individual CAPT of prosody often face difficulties when browsing the technology's UI (e.g. Anderson-Hsieh, 1994; Levis, 2007), find it challenging to interpret its visual illustrations of prosody and feedback (e.g. O. Engwall, Balter, Oster, & Kjellstrom, 2006; Stenson et al., 1992; Tanner & Landon, 2009), and often perceive the practice to be monotonous (e.g. Chiu et al., 2007; Tsai, 2006). Moreover, and while few studies attempted exploring collaborative CAPT like (e.g. Elimat & AbuSeileek, 2014; Tsai, 2015, 2019), they did not particularly focus on the practice of prosody features under such access mode with CAPT systems. This lack of research on collaborative CAPT of prosody comes in spite of the available collaborative CALL literature showing evidence on the benefits of collaboration in helping EFL students to tackle the technical, linguistic, and motivational challenges with CALL technologies (e.g. Jeon-Ellis et al., 2005; L. Jones, 2006; Warschauer, 1997). To address this gap, the current study employs the sociocultural theory (SCT) to explore its effectiveness and process with a specific focus on collaborative access to facilitate the practice of prosody features with CAPT. Such a fresh approach the study of CAPT helps in shedding on the extent to which collaboration with this technology to practice prosody features can help EFL learners overcome the technical, linguistic, and motivational challenges faced in individual CAPT of prosody.

On a methodological level, the current study contributes to the understanding of collaborative CAPT of prosody by employing a mixed-method approach of data collection. The previous research on CAPT of prosody has been predominantly conducted through purely quantitative approaches that mainly addressed the learning development after exposure with this technology (e.g. Elimat & AbuSeileek, 2014; Hincks & Edlund, 2009; Yenkimaleki & van Heuven, 2019). While this line of research has provided important findings about students' pronunciation learning, it has, however, overlooked the training process itself and paid little attention to social factors that could influence the learning. Therefore, the current study, and in addition to the quantitative pronunciation learning measures of prosodic quality and overall comprehensibility, also employs camera and screen recordings as tools to observe the practice process of collaborative CAPT of prosody and inner perception data collection tools (namely learning logs and interviews) to explore the practice process from students' perspective. Such an approach not only allows for the investigation of the influence of collaborative and individual

CAPT of prosody on participants' pronunciation learning, but also sheds light on the processes that contributed to such learning based on direct observation and participants' reports. With a better understanding of the learning processes in collaborative and individual CAPT of prosody, this study provides important information about the advantages and challenges that Algerian EFL students face when using CAPT technology under both access modes. Aware of these advantages and challenges, Algerian EFL teachers and EFL teachers in similar contexts can then design CAPT activities in accordance with the linguistic, technical, and psychological needs and aptitudes of their students.

1.5 Outline of the Thesis Chapters

The current thesis is divided into six main chapters.

Chapter 1 provides a general introduction to the current study and outline its chapters.

Chapter 2 presents the background of the study based on a systematic literature review of the research literature on EFL pronunciation and ASR based CAPT. The chapter first introduces the components of pronunciation instruction in the EFL classroom, its goals, and the factors influencing its instruction. In the second part, the chapter introduces the status of English as a foreign language in the Algerian linguistic context, the value of comprehensible English pronunciation in the Algerian job market, and the limitations facing prosody teaching and practice in the Algerian EFL classroom. To address such limitations, the chapter then presents CAPT technology as an alternative environment to practice prosody in the Algerian EFL context. In doing that, this section presents a systematic review of the studies investigating the effectiveness of the technology's unlimited input, self-paced practice, and immediate personalized feedback with EFL learners. Finally, the second chapter proposes collaborative CAPT of prosody as an alternative approach to the predominant individualistic CAPT and the limitations facing EFL students under such access. This last section defines the basic concepts of the sociocultural inspired collaborative CAPT, details its potential advantages with Algerian EFL learners when practicing prosody features, reviews the CAPT literature employing such mode of access, highlight the gaps in the literature, and presents the aim and research questions of the current study.

Chapter 3 details the methodological design of the current study. The chapter starts by describing the context, participants, groups of the study, and the procedure of the intervention. The chapter then presents the data collection and analysis tools employed in the study and explains the reasoning for their use. Finally, the methods chapter explains the ethical procedures and the consideration of the data quality.

Chapter 4 is dedicated to a systematic and detailed presentation of the study results in line with the order of the three research questions. The first section focusses on the pronunciation learning results obtained from the read-aloud tests conducted before and after the study. The second section focuses on the results generated through the classroom observation tools. Finally, the third section presents the results of students' perceptions generated by learning logs and interviews.

Chapter 5 discusses the results generated in this study in light of the previous research literature on pronunciation and ASR based CAPT and the theoretical framework adopted.

Chapter 6 presents a general conclusion for the study and details the theoretical, methodological, and practical contributions of the current study. The chapter also highlights the methodological limitations of this study and provides recommendations for future research.

Chapter Two: Literature Review

This second chapter provides the background of this study exploring collaborative CAPT of prosody with Algerian EFL learners based on a review of the research literature on EFL pronunciation and ASR based CAPT. The chapter starts by highlighting the importance of pronunciation for EFL learners and the pedagogy of its teaching and learning in the EFL classroom. This section includes an introduction to the components of pronunciation teaching in the EFL classroom (phonemes and prosody features) and a review of the literature on the pedagogy of pronunciation teaching and learning in the EFL classroom. The review looks at the history and status of pronunciation teaching in the EFL classroom, the different goals of pronunciation teaching, and the main factors influencing its instruction. The second part of this chapter tackles pronunciation instruction in the Algerian EFL classroom. This section first introduces the status of English within the Algerian linguistic context, explains the value of comprehensible pronunciation for Algerian EFL university graduates, and presents the limitations facing prosody instruction in the Algerian EFL classroom. ASR based CAPT technology is then presented as a valuable alternative tool to teach and practice prosody for Algerian EFL learners. This third section introduces the technical components of ASR based CAPT technology, explains how it can fit in the Algerian EFL classroom and how it can tackle the limitations of prosody practice through a systematic review of research studies on CAPT of prosody. Finally, the last section of the second chapter suggests collaborative CAPT of prosody given the limitations found in the predominant individual CAPT studies. This section defines the basic concepts of the sociocultural inspired collaborative approach, explains the potential advantages of such access mode to ASR based CAPT systems when practicing prosody features, and reviews the available literature investigating pair and group access to CAPT. The gap of the research literature on collaborative CAPT is then clearly articulated and followed by the aim and research questions of the current study.

2.1 The Pedagogy of Pronunciation Teaching in the EFL Classroom

Pronunciation, like other aspects of language such as vocabulary inventory and grammatical accuracy, is a necessary requirement for successful oral communication (Morley, 1991; Munro & Derwing, 1995). In fact, while the lack of vocabulary and grammatical inaccuracy can be forgiven by the listener or compensated by the speaker, poor pronunciation is more likely to cause communication breakdowns as it prevents messages from being transferred to the listener in the first place. Even in cases where the speaker has a rich vocabulary and accurate grammar, poor pronunciation can prevent communication from taking place. For example, the mispronunciation of words like “slip” and “sleep” or the misplacement of stress in the word

"present" (verb vs noun) can prevent communication from taking place despite the grammatical accuracy of utterances. The quality of pronunciation is particularly important in professional contexts where oral communication is necessary. In this regard, Matthews (2017) gave examples of how poor pronunciation of teachers and lecturers can negatively affect the delivery of their lessons. Other extreme examples about the importance of pronunciation were given by Derwing and Munro (2015) who showed how the mispronunciation of the words "two" and "to" in aviation communication resulted in two major accidents. In addition to its role in spoken communication, pronunciation is often perceived by both native and non-native speakers, as a reflection of the speaker's language level. During oral interactions, pronunciation illustrates, justly or unjustly, the first impression of the speaker's language proficiency. This impression, as highlighted by Nguyen (1993), can lead to unfair discrimination against the non-native language users. Evidence for such discrimination is often noticed in job recruitments where non-native speakers are often negatively judged about their language proficiency based on pronunciation. This premature assertion about a non-native speaker's language level due to their poor pronunciation can also be noticed in the workplace especially in jobs where oral interaction is necessary. Matthews (2017), for example, noted that Dutch students at Rotterdam University did not take their lecturers with accented English seriously. According to the author, this is because accented or unintelligible pronunciation is a sign that the speaker is part of an out-group and therefore often perceived as less credible.

2.1.1 The status of pronunciation in the language classroom

Despite its importance, the teaching of pronunciation in the EFL classroom, as in the L2 classroom, has often been neglected (Morley, 1991). Over the decades, the status of pronunciation in the language classroom has shifted with the evolution of language teaching methods and approaches. Along with the targeted accurate grammatical form, pronunciation was too an important component of the English language teaching within earlier approaches such as the grammar-translation method and the audiolingual method (Richards & Rodgers, 2014, p. 44). While grammar was responsible for the correct structure within such approaches, pronunciation was considered to be responsible for addressing the meaning in oral communication. Therefore, language teaching programs at the time aimed for native-like pronunciation paying equal attention to both word and sentence pronunciation (Morley, 1991). Pronunciation activities mainly relied on structural imitation and memorization of the speech models provided by the teacher through drills (Celce-Murcia, Brinton, & Goodwin, 1996, p. 03). Pronunciation errors and mistakes under such approaches were explicitly corrected by the teacher. This was mainly because such approaches regarded language as a set of forms and structures that ought to be memorized, repeated, and learned.

With the emergence of communicative language teaching approaches in the late 60s, however, the teaching of pronunciation in the classroom slowly diminished (Morley, 1991). This marginalization of pronunciation was the results of two prevalent beliefs during that era: 1) that pronunciation is a secondary quality in spoken communication, and 2) that pronunciation teaching is a futile exercise. The first belief was a direct result to the philosophy of the communicative language teaching approach which prioritized meaning over form in language learning and therefore comprehensible pronunciation instead of native-like pronunciation (Richards & Rodgers, 2014, p. 67). In other words, the focus was on what the speaker says instead of how s/he says it. This leads to the second belief which considered pronunciation teaching in the language classroom as a useless process that could only yield limited if no development. Such negative beliefs about pronunciation teaching were mainly the result of earlier language teaching approaches which primarily aimed for native-like pronunciation during an era which lacked enough empirical evidence about the teachability of pronunciation (Morley, 1991). These beliefs were further reinforced with (at the time) the increasing influence of the critical period hypothesis (CPRH) underlying that the ability to master the L2 and its pronunciation decreases as we grow older (Lenneberg, 1967). As a result, many language teaching programs and materials during that era paid little attention to explicit pronunciation instruction.

The early 80s, on the other hand, witnessed a revived interest in L2 pronunciation. This decade was especially characterized by the reexamination of the concept of pronunciation and the state of pronunciation within language education (Morley, 1991). For example, Leather (1983) called for a reevaluation of the pronunciation goals set within second language education (at the time) and the factors that might be influencing the attainment of such goals. Following such a trend, Pennington and Richards (1986) called for explicit pronunciation teaching that addressed individual sounds (vowels and consonants), words, and sentence pronunciation. Such movement came to acknowledge the importance of pronunciation and, more importantly, to redirect its teaching in the language classroom into a more achievable process. This has paved the way for a more pragmatist views about pronunciation like that of Munro and Derwing (1995) who made a clear distinction between aiming to reduce accent or aiming for intelligible and comprehensible pronunciation. Such new perspective to L2 pronunciation paved the way for the reexamination of L2 pronunciation pedagogy and helped teachers reconsider pronunciation in the language classroom and set more achievable learning goals.

This revived interest in pronunciation also helped in growing a body of literature showing positive evidence for the teachability of L2 pronunciation (e.g. Barrera Pardo, 2004; Thomson & Derwing, 2014). Starting from the early 90s, L2 pronunciation studies highlighted the effectiveness of teaching both individual sounds (e.g. Elliott, 1995; Saito, 2011a) and connected

speech (e.g. Anderson-Hsieh, 1990). In a similar vein, other studies compared between the effectiveness of pronunciation instruction of individual sounds and global pronunciation (Derwing, Munro, & Wiebe, 1998). Moreover, L2 pronunciation studies provided positive evidence for pronunciation learning through measures of accentedness, intelligibility, and comprehensibility (e.g. Derwing et al., 1998; Thompson, 1991). Such pronunciation learning development were detected with different age groups (e.g. T. Bongaerts, 1999) and with advanced adult L2 learners who were thought of as fossilized learners (e.g. Derwing, Munro, Foote, Waugh, & Fleming, 2014).

2.1.2 Aspects of pronunciation teaching in the EFL classroom

When addressing pronunciation in the EFL classroom, there are two main foci of pronunciation teaching: 1) a phonemic (also called segmental) focus where individual sounds are taught, and 2) a prosodic, or so-called suprasegmental, focus where the pronunciation of words and sentences are taught. The current study focuses mainly on the prosodic component of pronunciation through sentence pronunciation activities with the CAPT technology employed in the current study. Such focus stems primarily from the reality and goals of pronunciation teaching in the Algerian EFL context (see **Chapter 2**, Section 2.2.3). This section first introduces the two components of pronunciation, explain their role in English pronunciation, and provide examples of their use.

2.1.2.1 Phonemes (Segmentals)

The phonemic aspect of pronunciation teaching focusses on the pronunciation of vowels and consonants. When practicing such components of English pronunciation, teachers often employ phonetic transcription adopting the International Phonetic Alphabet (IPA). Such alphabets are a set of symbols developed and introduced by the International Phonetic Association aiming to represent the segmental sounds accurately for languages that employ the Latin Alphabets (Reed & Levis, 2015, p. 69). Phonemic activities can directly involve the practice of individual phonemes (although this is preferred at a beginner level) or the practice of phonemes within words or sentences. The aim of phonemic practice is to raise EFL students' awareness of the phonemic segments of the English language or to help them overcome problematic segments where they find difficulties pronouncing particular sounds (Saito, 2011a). The following table summarizes the phonetic alphabets used to represent vowels and consonants in the English language:

Table 2.1 Phonemic symbols of the English language

Vowels and diphthongs		**Consonants**	
Phonetic symbols	Examples	Phonetic symbols	Examples
iː	See	p	Pet
ɪ	Hit	b	Bad
ʊ	Put	t	Tea
uː	Food	d	Did
ɪə	Near	tʃ	Check
eɪ	Eight	dʒ	June
e	Bed	k	Car
ə	Away	g	Give
ɜː	Learn	f	Find
ɔː	Door	v	Voice
ʊə	Pure	θ	Think
ɔɪ	Boy	ð	This
əʊ	Show	s	Sun
æ	Cat	z	Zoo
ʌ	Cup	ʃ	She
ɑː	Far	ʒ	Vision
ɒ	On	m	Man
eə	Air	n	No
aɪ	Eye	ŋ	Sing
aʊ	Now	h	Hat
		l	Love
		r	Red
		w	Window
		j	Yes

Note. Underlined segments represent the sound of the phonetic symbols.

Adopted from (Avery, 1992, p. 07)

2.1.2.2 Prosody (Suprasegmentals)

The prosodic aspect of pronunciation, on the other hand, deals with word and sentence pronunciation and mostly include: syllable stress, sentence stress, and intonation. *Stress* in pronunciation, as defined in Derwing and Munro (2015, p. 59), refers to an emphasis on a particular syllable within a word or a word within a sentence. In a stress-timed language like English, syllable and sentence stress patterns highlight the meaning of spoken utterances and

give them the unique musical rhythm of English pronunciation (Kenworthy, 1987, p. 30). At a word level, the stress takes place at the level of syllables and consequently affect the meaning of a word. For example, through the stress on the first syllable of "**pres**ent", the listener can realize that the speaker is referring to the noun (i.e. the period of time taking place now). Meanwhile, if the stress in on the second syllable of "pre**sent**", the listener can realize that the speaker is referring to the verb present (i.e. to display or offer something). On a sentence level, the stress takes place on the level of words to highlight the meaning of the produced utterance. This is done by emphasizing the content words which carry the meaning (verbs, adjectives, and adverbs) and deemphasizing function the function words which are responsible for grammatical accuracy (articles, auxiliaries, demonstratives, prepositions, pronouns, and conjunctions). For example, the pronunciation of the sentence "I **bought** a **car** on **Tuesday**", the words "bought", "car", and "Tuesday" are emphasized given their crucial role in addressing the meaning of the sentence, and the words "I", "the", "a", and "on" are de-emphasized as they only contribute to the grammatical structure of the sentence. This, however, is not a fixed rule as different words can be stressed or unstressed depending on the context in which they are produced. For example, the pronoun "I" in the last example can be emphasized if the speaker wants to emphasize that s/he was the one who bought the car.

Intonation refers to the pitch variation when pronouncing a word or a sentence (Reed & Levis, 2015, p. 139). English intonation includes four pitch variations: falling intonation, rising intonation, fall-rise intonation, and rise-fall intonation. Such variations in pitch, and unlike stress, influences the type of an utterance more than its literal meaning. For this reason, intonation can make the difference between a declarative statement, an interrogative statement, or an exclamatory statement. For example, in the use of a falling intonation in the sentence "you parked the car outside", the listener can perceive it as a declarative statement providing an information about parking the car. However, in the use of a rising intonation in the same sentence "you parked the car outside?", the listener would perceive it as a question and/or an exclamatory statement. Generally speaking, rising intonation is mostly used for interrogative and exclamatory statements, while falling intonation is used for declarative and command statements. Such functions, however, are characterized by irregularity as different intonation directions can influence statements differently depending on the context they are employed in (Derwing & Munro, 2015, p. 61).

The teaching of prosody features in EFL contexts usually centers around raising EFL students' awareness of such features and, especially, their influence on meaning. As highlighted by Pennington and Ellis (2000), the more students are able to perceive these features and their influence on meaning, the more they will be able to use them effectively. Typical practices of

such features could involve perception activities, in which students are exposed to speech input that is rich of prosody, or production activities which allow EFL students to practice prosody through role-plays, interviews, or debates. Students' perception of prosody in perception activities is often measured through listening activities where students listen to speech recordings (usually by native speakers) and are expected to mark pauses, stress, and intonation directions on the written transcription of the recording. As for production activities, students are assessed based on their use of prosody features in scripted or spontaneous speech. However, the assessment of prosodic pronunciation, unlike phonemic pronunciation, is less systematic due to the irregularity that characterizes prosody features (Derwing & Munro, 2015, p. 60). It, therefore, requires the teachers' awareness of such features and their function in sentence pronunciation.

Prosodic features in English pronunciation have received increased attention from both researchers and teachers due to their significant influence on meaning within oral communication (Avery, 1992, p. 73; Kang, 2010). While phonemic features promote EFL learners' phonological accuracy, especially with beginner EFL learners, prosodic features carry information which facilitates listener's detection of the type of statements produced by the speaker (e.g. declarative statement, interrogative statement, or exclamatory statement) (Meng, Tseng, Kondo, Harrison, & Viscelgia, 2009). However, despite the significant role of supra-segmental features in the understanding of EFL learners' speech, pronunciation research tends to focus on segmental features. The current study focusses primarily on prosodic features as a crucial aspect for a comprehensible pronunciation. Such a goal of pronunciation learning and others, like accentedness and intelligibility, are explained in the following section.

2.1.3 The goals of pronunciation teaching

The current study takes pronunciation comprehensibility as the target goal for pronunciation learning with EFL learners. Historically speaking, the teaching of EFL pronunciation aimed at three different goals, namely: native-like pronunciation, comprehensible pronunciation, and intelligible pronunciation (Munro & Derwing, 1995). The interest in each of these goals has increased and evolved over time in accordance with an increasing understanding of the nature of pronunciation teaching and learning and the needs of EFL students in different contexts. This section details the three pronunciation learning goals available in the EFL pronunciation literature, critically evaluate them, and justify the comprehensibility goal adopted in the current study.

2.1.3.1 The native-like pronunciation goal

The native-like pronunciation goal is considered to be the most traditional goal in the EFL pronunciation literature (Morley, 1991). Proponents of the native-like pronunciation argue that the aim of teaching pronunciation is to enable EFL students to speak the target language as it is meant to be spoken by native speakers on both phonemic and prosodic level (Griffen, 1980). Under such pronunciation goal, accentedness, which is defined by the degree of resemblance between the EFL learner's pronunciation and that of a native English speaker (Derwing & Munro, 2009; Kennedy & Trofimovich, 2008), is regarded as a pronunciation flaw that needs to be addressed and mitigated. Therefore, EFL students are expected to reduce their accent in English pronunciation production so that they achieve a pronunciation that is indistinguishable from native speakers. This approach to pronunciation teaching, although less popular in the last three decades, has led to emergence of language teaching programs and computer technologies that aim for accent reduction (Seferoğlu, 2005).

Such a goal in pronunciation teaching, however, has often been criticized for being pedagogically ambiguous and unrealistic (Levis, 2005; Morley, 1991; Munro & Derwing, 1995). Pedagogically speaking, setting the native-like pronunciation as a goal in the EFL classroom creates another debate about the model that should be employed as the target. With English having multiple varieties like British and American, varieties within varieties, and the emergence of world Englishes due to the increased use of English globally, this goal for teaching pronunciation is misleading for teachers and students alike (Derwing, 2010; Jennifer Jenkins, 1998; Levis, 2005). Moreover, setting the native-like pronunciation goal can be very discouraging for students. A common consensus within the EFL pronunciation literature suggests that only few students can achieve a near-native or a native-like English pronunciation (Derwing & Munro, 2009). And while such difficulty in attaining a native-like pronunciation has often been attributed to a critical period during which the biological processes involved in language learning slow down (Lenneberg, 1967), others, like James Emil Flege (1987) and Hyltenstam and Abrahamsson (2000), doubt this hypothesis and argue that the inability to achieve such goal can be due to other factors such as exposure to the target language. In either way, the high likelihood of failing to achieve a native-like pronunciation by EFL students, which can discourage them, should alone be an excuse for teachers to avoid setting it as a learning goal. Alternatively, both teachers and students can strive and succeed in achieving more realistic and pragmatic pronunciation goals like intelligibility and comprehensibility.

2.1.3.2 Intelligibility and comprehensibility

An alternative approach to native-like pronunciation, and a more recent one, is that which aims for more realistic and achievable pronunciation goals, namely: intelligibility and comprehensibility. In L2 pronunciation literature, the concept of intelligibility has often been used interchangeably when referring to two slightly different qualities of pronunciation, namely: speech intelligibility and phonological accuracy. On the one hand, Munro and Derwing (1995), define intelligibility as the degree to which the meaning of a spoken utterance is understood by the listener. In other words, intelligibility refers to the extent to which the listener was able to understand the meaning or the message of the utterance pronounced by the speaker. Smith and Nelson (1985), on the other hand, argues that intelligibility is determined by the listener's ability to recognize the words and utterances produced by the speaker. In this sense, intelligibility refers to understanding specific words as opposed to the message being addressed. Despite such dispute over the definition of the concept, intelligibility has been mostly measured through transcription tasks (Kang, Thomson, & Moran, 2018). Under such measurement process, words and sentences are read aloud by an EFL speaker and recorded. The degree of intelligibility is then determined by the percentage of correctly transcribed words and sentences by the listener.

Another recent realistic pronunciation goal, and one that is adopted in the current study, is comprehensibility. Similar to intelligibility, the concept of comprehensibility too has often sparked disagreement among pronunciation researchers. According to Munro and Derwing (1995), pronunciation comprehensibility refers to the listener's judgement of the difficulty and the effort made to understand the speaker. Smith and Nelson (1985), on the other hand, define comprehensibility by the extent to which the listener is able to understand the addressed meaning by the speaker. Despite such disagreement, comprehensibility, and under both definitions, has largely been measured through scalar judgment tests (Kang et al., 2018; Levis, 2018). This measurement approach involves the scalar rating of previously recorded, scripted or spontaneous, pronunciation output. While Munro and Derwing (1995) rely on a nine points scale reflecting the extent to which the listener made an effort to understand the pronunciation output (e.g. from 1=extremely hard to understand to 9=extremely easy to understand), the Smith and Nelson (1985) approach rely on the same scale to reflect the extent to which the listener understood the speaker (e.g. from 1=I did not understand the speaker to 9=I fully understood the speaker). It is this similarity of measuring comprehensibility in Munro and Derwing (1995) and Smith and Nelson (1985) that gave way to the argument that both measures are generating the same pronunciation quality, that is overall comprehensibility (Kang et al., 2018).

2.1.3.3 Comprehensibility as the pronunciation learning goal for the current study

The current study takes pronunciation comprehensibility as the target goal for pronunciation learning of Algerian EFL students. The comprehensibility goal has been chosen due to its importance for communication, the high likelihood of its achievability by EFL students, and its positive correlation with prosody features (the target pronunciation component in this study). As for the terminology, and even though the term intelligibility can be used interchangeably when referring to the two pronunciation qualities defined above, the current study uses the term pronunciation comprehensibility instead of intelligibility. This is mainly because the term intelligibility is sometimes used when referring to phonological intelligibility rather than overall comprehensibility. Therefore, the term pronunciation learning used in the methodology, results, and discussion chapters is used in reference to the progress in EFL students' ability to convey meaning through their pronunciation.

Overall, comprehensibility is a crucial quality for the success the communicative function of EFL pronunciation (Munro & Derwing, 1995; Smith & Nelson, 1985). While phonological accuracy is limited to the listener's understanding of the speakers' utterance at a local level (i.e. words), comprehensibility exceeds it by focusing on the overall meaning which is more important in oral communication. In an interpretation of the results of her study, Isaacs (2008), argued that comprehensibility is often more important than the phonological accuracy of individual words. In many cases, the speaker can be phonetically accurate (i.e. the listener is able to detect) but is not completely comprehensible. Alternatively, the comprehensibility quality in spoken communication cannot be compromised.

Moreover, the EFL pronunciation literature considers comprehensibility as a realistic and achievable goal for learners. This has been demonstrated with empirical research showing evidence for the progress of EFL learners' pronunciation when measured by its overall comprehensibility. Such learning progress has been previously detected by the pronunciation literature addressing the influence of explicit teaching of pronunciation (e.g. Saito, 2011a) or exposure to the target language in everyday life (e.g. Derwing et al., 2014). Saito (2011a), for example, examined the influence of phonetic instruction of specific segments on the pronunciation learning of adult Japanese EFL learners. The training with the treatment group lasted four hours (one hour each week) and addressed the pronunciation of the phonemes /æ,f,v,θ,ð,w,l/. While no accentedness reduction was detected, results of the study showed a progress in the EFL learners' overall comprehensibility ratings. In their study, Derwing et al. (2014) examined the influence of living in an English-speaking environment on ESL/ EFL speakers' pronunciation. While no improvements were detected on the level of accent and

fluency, the study found a significant progress in the overall comprehensibility of the ESL/ EFL speakers.

Unlike phonological intelligibility, which relies primarily on phonemic accuracy in pronouncing words (J. Jenkins, 2002), comprehensibility is also attributed to prosody features along with phonemic features (Cutler, Dahan, & van Donselaar, 1997). This is not to ignore the important role of segmental features in comprehensibility, as highlighted in Derwing and Munro (1997), Saito (2011b), and Saito et al. (2016), but to emphasize the important role of suprasegmental features in pronunciation comprehensibly as opposed to phonological intelligibility. Derwing and Munro (1997), for example, explored the factors affecting native speakers' perceived comprehensibility of 48 ESL students from mixed linguistic background. Results of this study indicated that prosodic features, along with other linguistic factors like grammar and speech rate (syllables per second), constituted an important factor in the judgement of comprehensibility. In another more recent study, Saito et al. (2016) assessed the correlation between different linguistic factors and pronunciation comprehensibility with 120 Japanese EFL students. Unlike in Derwing and Munro (1997), this study looked at the contribution of prosody features to comprehensibility focusing on specific prosody features, namely: word stress and intonation. Participants description of pictures was recorded and rated in terms of its accentedness and comprehensibility. Results of this study showed that prosodic features like word stress, intonation, and speech rate played an important role in the comprehensibility of participants.

2.1.4 Factors affecting pronunciation instruction in the language classroom

The learning of L2 pronunciation in the language classroom, like other aspects of language as vocabulary and grammar, is affected by a set of factors that can boost or hinder the students' ability to achieve their target goal. Evidence from L2 pronunciation literature highlight four main factors that can significantly influence the learning and development of L2 pronunciation in the classroom, namely: exposure to L2 pronunciation input, opportunities to practice L2 pronunciation output, corrective feedback, motivation, and age (e.g. J. E. Flege, Munro, & MacKay, 1995; Gilakjani, 2012; Piske, MacKay, & Flege, 2001). This section of the second chapter introduce and discuss these factors and the extent to which each one affects L2 pronunciation learning in more detail.

2.1.4.1 Exposure to pronunciation input

As is the case with other language skills, the development of EFL learners' pronunciation relies heavily on the amount of input they are exposed to. In language research, the recognition of the role of the input factor in language learning originates from Krashen's (1985) input hypothesis

which argues that comprehensible input is a crucial aspect of language learning. By comprehensible input, Krashen refers to input that is only one degree above the language proficiency level of the students and, therefore, can be understood by him/ her without having prior knowledge about every word. In line with this hypothesis, L2 speech researchers advocate for the integration of comprehensible input in the teaching of pronunciation to raise students' awareness of the phonological features in the target language (Leather & James, 1996). Pronunciation input can take a textual form through phonics (the relationship between sounds and their alphabetical spelling) and phonetic alphabets (the visual representation of speech sounds) or audio form where students are introduced to the sounds of the target language through audio speech models (often recorded by native speakers) which can also be accompanied with their acoustic or pictorial/ video representations.

Empirical evidence in the L2 pronunciation literature shows that exposure to pronunciation input in the target language can have a significant positive effect on learners' phonological awareness (Anthony & Francis, 2005; Bruck & Genesee, 1995; Caravolas & Bruck, 1993). Phonological awareness, as defined by Venkatagiri and Levis (2007), refers to the extent to which the L2 learner is knowledgeable of the phonological structures in the target language including both phonemic and prosodic features. In their study, Caravolas and Bruck (1993) investigated the influence of basic literacy instruction on the phonological awareness of one hundred Czech and 101 English speaking Canadian children aged between 4 and 6 years old. To assess phonological awareness the study employed phonemic differentiation, sound isolation, phonemic deletion, and nonword spelling tests. The results of the study showed that oral and written input presented in early literacy instruction has a significant influence on phonological accuracy. Bruck and Genesee (1995) also found similar results about the effectiveness of oral and written input in developing the phonological accuracy of 91 English learners of French (age 5 to 9). In a more recent study with 10 EFL learners from mixed L1 backgrounds in Canada, Kennedy and Trofimovich (2010) found a strong correlation between exposure to audio input outside the classroom and prosodic awareness.

In turn, phonological awareness in L2 pronunciation literature is considered as a crucial predictor of comprehensible and intelligible pronunciation (E.g. Celce-Murcia et al., 1996; Venkatagiri & Levis, 2007). For example, Venkatagiri and Levis (2007), looked at the correlation between phonological awareness and pronunciation comprehensibility. The study was conducted with 17 adult EFL learners (mixed L1 backgrounds) who completed phonological awareness and pronunciation production tests. The phonological awareness addressed students' explicit knowledge of English phonology and short-term memory. Meanwhile, the pronunciation production tests included controlled read aloud and spontaneous picture narration tasks. The findings of the study revealed a strong positive correlation between

phonological awareness and overall comprehensibility. Similar results were also found by Kennedy and Trofimovich (2010) who engaged 10 EFL students in a 13-week pronunciation course focusing on suprasegmental features. Participants' phonological awareness was tracked through learning logs and their pronunciation was assessed through read aloud activities that were rated in terms of accentedness and comprehensibility. The findings of the study showed a significant correlation between participants' phonological awareness and their pronunciation quality.

Due to the strong link between exposure to pronunciation input, phonological awareness, and pronunciation development, many researchers give considerable attention to exposure to input outside the classroom (Celce-Murcia et al., 1996, p. 16). This attention is based on the assumption that L2 learners who have more interest in the target language and are more willing to have contact with native speakers, watch movies, and listen to music in the target language are more likely to improve their pronunciation. This assumption is further confirmed with evidence in L2 pronunciation literature showing a significant correlation between off classroom exposure to input in the target language and development in pronunciation intelligibility and comprehensibility (E.g. Gilakjani, 2012; Piske et al., 2001). For this reason, exposure to input outside the classroom is considered as a factor that significantly affects pronunciation learning.

Overall, based on evidence in the pronunciation literature, input can be considered as a fundamental requirement for L2 pronunciation learning. However, it is important to point out that the availability of comprehensible input alone does not guarantee pronunciation learning. Input in pronunciation instruction, as with other aspects of language, should be presented in an interesting and meaningful way. Evidence suggests that students benefit more from an input that is compatible with their background knowledge, stimulate their interests, and is useful for their daily and professional use of the target language (Dörnyei, 1998). Pronunciation input should also accommodate the different learning styles and preferences of L2 students (Hsu, 2016; Neri, Cucchiarini, Strik, et al., 2002). While some students can benefit from textual input, other students prefer audio-visual input to learn and increase their awareness of the segmental and suprasegmental features of L2 pronunciation.

2.1.4.2 Opportunities to practice pronunciation

In addition to input, pronunciation learning requires opportunities for practicing output. This view in language research originates from Swain's (2000) output hypothesis arguing that second language learning relies heavily on practicing the output of the target language. In speech, practice allows L2 students to first monitor and evaluate their own pronunciation output through a process known as proprioceptive and tactile feedback (DeBot, 1983). Proprioceptive feedback refers to the speaker's ability to hear his/ her speech output produced through air and bone

conduction and received by the ear. On the other hand, tactile feedback refers to the reception of information about the movements of organs of speech by the brain. Through this self-assessment, the speaker is able to reproduce their speech output and readjust it until it matches the aspired pronunciation model (De Bot, 1996). Moreover, in a classroom context, more practice opportunities are very likely to increase the chances of receiving peer or teacher feedback (Swain & Lapkin, 1995). This internal and external feedback helps students to increase their awareness of their output quality and work on their pronunciation problems.

Evidence in L2 pronunciation literature suggests that opportunities to practice pronunciation can result in significant learning developments in both intelligibility and comprehensibility (e.g. Kendrick, 1997; Gillian Lord, 2010). Kendrick (1997), for example, explored the effectiveness of different methods in improving the pronunciation of eight teenage EFL learners from Japanese (3), Russian (1), Korean (2), Taiwanese (1), and Thai (1) L1 backgrounds. The study engaged the participants in pronunciation training sessions aimed at both the perception and production of segmental and suprasegmental features. The sessions lasted 40 minutes and took place from one to four times a week for three academic terms. For data collection, the study followed a mixed-method approach employing pronunciation perception and production tests, classroom observation, and semi-structured questionnaires. The findings of the study showed that the participants made significant learning developments in intelligibility, phonemic accuracy, and prosodic accuracy. Based on the qualitative results generated through classroom observation and students' learning logs, the significant pronunciation learning developments were highly correlated with students talking time.

Support for the claim highlighting the importance of practicing input for the development of pronunciation is also often based on the evidence from the literature showing the positive effect of living abroad on L2 students' pronunciation. For example, Gillian Lord (2010) investigated the effectiveness of immersion in a target language community along with explicit instruction on L2 pronunciation. The study engaged eight L2 Spanish learners in 8 weeks university immersion program in Mexico. Participants' pronunciation production was assessed before and after the study through read-aloud activities containing 60 words. The recordings were then analyzed phonetically using the audio program Signalyze to calculate the phonemic error ratio for every recording. The results of the study showed that immersion in the target language community along with explicit pronunciation instruction had a significant positive effect on students' pronunciation learning. This is mainly because immersion provided students with more opportunities to practice the pronunciation features they were learning.

In fact, the results found by Theo Bongaerts, Mennen, and Slik (2000) showed that immersion in the target language community can also help adult L2 learners to achieve a near native-like pronunciation at an advanced age. The participants who took part in this study were

30 adult learners of Dutch from different L1 backgrounds with a mean age of arrival to the Netherlands of 21. Participants' pronunciation output was recorded during read-aloud tasks. The pronunciation output was then rated by 21 native speakers of Dutch in terms of accentedness and compared to the output of ten native speakers. The findings of the study showed that participants who were married to Dutch partners and spoke only Dutch at home were able to achieve a native-like pronunciation. Such results showed that increased opportunities for practicing pronunciation in a naturalistic and immersive setting can have a significant positive effect on L2 learners' pronunciation.

In language classroom settings, however, the opportunities to practice pronunciation output should be provided through meaningful activities and a stress-free environment. In many cases, whether it being the language classroom or immersion in the target language community, L2 learners are provided with opportunities to produce pronunciation output, yet they face motivational and stress challenges that hinder their willingness to practice (Morley, 1991). For such reasons, teachers are often advised to avoid decontextualized and meaningless drilling of words and sentences in isolation (R. Jones, 1997). Instead, more recent pronunciation teaching materials and guides advocate for socially meaningful activities and simulations of dialogues that occur in everyday life (E.g. Derwing & Munro, 2015; Yoshida, 2016). Moreover, it is necessary to create an environment where students feel comfortable to practice their output without feeling stressed or harshly judged. This is particularly important when considering the results of studies like that of Baran-Łucarz (2014) which highlighted a strong link between pronunciation anxiety (defined as negative self-perception of output) and willingness to practice. The study employed a mixed-method approach in which 151 adult Polish learners of English filled semi-structured surveys focusing on their willingness to practice and levels of pronunciation anxiety. The results of the study showed that learners who had high pronunciation anxiety were significantly less willing to engage in practice out of fear from negative judgment from their peers or the teacher.

2.1.4.3 Corrective feedback and EFL pronunciation learning

Another important factor for the learning of L2 pronunciation in the language classroom is corrective feedback. When dealing with L2 pronunciation, corrective feedback (CF) refers to a response provided by the teacher or a peer to correct an utterance produced and contains an error. According to Lyster and Ranta (1997; 2007), corrective feedback can be classified into two main categories: prompts and reformulations. Prompts refer to instances of feedback where the teacher provides signals to help the learner repair their output. On the other hand, reformulations refer to instances of feedback where the teacher provides a recast repeating the student's output with a correction to the error. Both types of feedback, as explained by

Younghee Sheen and Ellis (2011), can be provided explicitly, where the teacher clearly and plainly explain or hints for the correction, or implicitly, where the teacher insinuate the correct form (recast) or the rule of correcting the output (e.g. metalinguistic feedback).

Feedback on pronunciation, as highlighted by Long (1996), is an effective approach in making students notice the difference between their output and that of the target language model. Consequently, students will be able to work on their pronunciation errors and mistakes. Such assumption about the effectiveness of corrective feedback in the language classroom has often taken an important interest within the L2 pronunciation literature. The importance of the feedback factor in language research originally emerged with Schmidt's (1992) noticing hypothesis and focuses on raising students' awareness of their language production. More recently, Lyster, Saito, and Sato (2013) reviewed the research literature on oral corrective feedback in second language classrooms. The review included studies on the effectiveness of different types of CF in classroom and laboratory settings. Overall, the review concluded that empirical evidence within the literature confirms that oral CF has a significant influence on L2 students' learning gains. The review also highlighted that explicit corrections are significantly more effective in helping L2 students detect and work on their errors than recasts despite the last being more frequent in language classrooms.

Although scarce, research interest on the influence of corrective feedback on L2 pronunciation learning has recently increased. Saito and Lyster (2012) looked at the effectiveness of form-focused instruction with corrective feedback on the pronunciation of /ɹ/ by 65 Japanese EFL learners. The participants engaged in four hours of training designed to raise students' attention to the phonemic feature /ɹ/. Acoustic analysis was used to assess students' production. The findings of the study showed that the pronunciation of the target feature /ɹ/ has significantly improved with participants receiving instruction with corrective feedback in both controlled and spontaneous speech. In a more recent study, A. Lee and Lyster (2016) investigated the extent to which the speech perception of 32 adult Korean EFL learners benefit from instruction that includes corrective feedback. The study lasted for five sessions (of 1 hour) of form-focused lessons that addressed students' attention to phonemic contrasts /i/ and /ɹ/ and assessed students' perceptions through forced identification tasks. The results of the study showed that the instruction of feedback had a significant influence on students' perceptual performance.

Overall, the available evidence in both L2 pronunciation literature shows that corrective feedback has a significant influence on EFL students' pronunciation learning as with other language skills (e.g. A. Lee & Lyster, 2016; Saito & Lyster, 2012). However, the type and delivery of corrective feedback on pronunciation should also receive similar attention due to their importance. When looking at the type of feedback, a common finding is that corrective

feedback has more influence on students learning than simple recast (Lyster et al., 2013). This is mainly because corrective feedback highlights the error and facilitates the correction. Meanwhile, recasts, and although they are found to be more frequent in classroom settings, correct the mistake but do not leave space for learners to understand their pronunciation problems. Moreover, feedback on pronunciation should be corrective, comprehensible, and take into consideration the psychological state of the students (Lyster & Ranta, 1997). In other words, it should be able to make students realize and correct their mistakes in a meaningful way while also encouraging them and preventing them from unnecessary judgmental remarks that could negatively influence their future participation attempts.

2.1.4.4 Motivation and EFL pronunciation learning

Motivation is another factor that is often associated with L2 pronunciation learning (Gilakjani, 2012; Piske et al., 2001). According to Dornyei and Ryan (2015), "motivation provides the primary impetus to initiate L2 learning and later the driving force to sustain the long, often tedious learning process" (Dornyei & Ryan, 2015, p. 72). According to such definition, all the aspects of learning a second/ foreign language are, to an extent, reliant on the motivation of the student. In L2 research, motivation has been conceptualized through different definitions and models like the L2 Motivation Model (L2M) and the L2 Motivational Self-System (L2MSS). In the L2 Motivation Model (L2M), Gardner (1985) viewed L2 motivation as a favorable attitude from the L2 learner towards the target language community, possibly as a wish to integrate and adapt to a new target culture through the use of the language (Gardner, 1985, p. 54). More recently, such conceptualization of L2 motivation has decreased in favor of the definition adopted in Dörnyei's (2009) L2 Motivational Self System (L2MSS). Such model regards L2 motivation as a combination of three main subcomponents, namely: the *Ideal L2 self*, *the Ought-to L2 Self*, and the *L2 learning experience*. The *Ideal L2 Self* represents an ideal image in the mind of a student about their preferred future L2 self. The *Ought-to Self*, on the other hand, represents the set of skills a student believes s/he ought to possess to avoid possible negative outcomes. As for the *L2 learning experience*, it refers to the influence of the learning environment (e.g. classroom, teacher, curriculum).

Since the emergence of the integrativeness motivation model, research on the relationship between motivation and L2 motivation has increased and evolved. In their recent review of 416 empirical studies, Boo, Dörnyei, and Ryan (2015) highlighted a recent sharp increase in L2 motivation research since 2005 (i.e. since the L2MSS model was first presented). As far as empirical evidence is concerned, a considerable number of studies highlight a positive correlation between motivation and L2 achievement. In their review of L2 motivation literature (between 1970s & 1990s), Masgoret and Gardner (2003), conducted a meta-analysis involving

73 independent samples and more than 10000 participants. The results showed that the correlation between motivation and L2 learning is largely positive. In a more recent study, Lasagabaster (2011) investigated the relationship between motivation and overall English achievement with 191 Spanish and Basque EFL learners. The findings showed that EFL students with better motivation performed better than their less motivated counterparts. Contradicting results were, however, found by Moskovsky, Assulaimani, Racheva, and Harkins (2016) who found that the level of motivation was not particularly related to Saudi EFL students overall language achievement. Such results are often used to justify the skepticism surrounding the significance of the correlation between motivation and L2 achievement given the confounding factors such as age & exposure to the target language (Muñoz, 2008).

In line with such an increasing trend of L2 motivation research, the increasing empirical evidence in L2 pronunciation literature shows a strong positive correlation between motivation and students' L2 pronunciation learning. Saito, Dewaele, and Hanzawa (2017), for example, investigated the influence of learner motivation on L2 speech learning in a classroom context with 40 adult Japanese EFL learners. The study employed structured questionnaires with 13 scale items to shed light on the trajectory of students' motivation and image description to elicit spontaneous speech and assess students' pronunciation on comprehensibility and accentedness. Results of the study showed that the students who made significant learning development in their pronunciation comprehensibility had a high motivation to develop their comprehensibility (as opposed to their accentedness) to help them in their career.

In a more recent study, Nagle (2018) examined the relationship between motivation and the longitudinal development of L2 pronunciation with 26 English learners of Spanish. The study employed picture descriptions five times during three semesters to elicit pronunciation development. To track learners' motivation, a semi-structured questionnaire was employed. The results of this study showed that learners' overall pronunciation comprehensibility and accentedness improved significantly over the study duration. When pronunciation development was compared with students' motivation, accentedness was found to be significantly affected by individual students' levels of motivation. This, according to the author of the study, is mainly because students were aligning their pronunciation effort with their future personal and professional goals which prioritized a free accent pronunciation.

In another study, Sardegna, Lee, and Kusey (2018) looked at the role of self-efficacy, attitudes, and choice of strategies for English pronunciation learning. To do this, the study employed a semi-structured questionnaire that was completed by 704 EFL students from South Korea aged between 14 and 17 years old. The results showed that students with high self-

efficacy tended to put more effort into findings ways to improve their pronunciation. Moreover, the results also highlighted that the more students were aware of the practical importance of pronunciation in their career, the more they felt pressured to take action to improve it.

Overall, motivation is an influential factor in learning L2/ EFL pronunciation as it is with overall language achievement. While the results of L2 motivation research provided mixed positive (e.g. Lasagabaster, 2011) and negative results (e.g. Moskovsky et al., 2016), research on the correlation between motivation and L2 pronunciation learning has provided consistently positive results between the learners motivation and the development of an aspect of their pronunciation (e.g. Nagle, 2018; Saito et al., 2017; Sardegna et al., 2018). Based on the evidence within the reviewed studies, future career goals play a significant influence on students' motivation to develop their pronunciation in the target language. In other words, students can choose to work on their comprehensibility or accentedness based on their future plans (e.g. studying abroad, teaching English). It is, however, important to note that research in this area is still developing and therefore it is difficult to draw final conclusions.

2.1.4.5 Age and pronunciation learning

One claim that is often found in L2 research is that second language learning is affected by biological age. Such a claim is particularly illustrated in the Critical Period Hypothesis (CPH) which suggests that the rate of language learning diminishes as learners grow older (Lenneberg, 1967). From a biological standpoint, this decrease in language learning rates has been attributed to an age-related decline in neuroplasticity (Lenneberg, 1967; Scovel, 1969). In other words, the rate of neurological reorganizations that takes place during language development slows down with biological age. From a linguistics point of view, the decrease in language learning has been largely attributed to the increasing influence of L1 on L2 with age. According to James Emil Flege (1987), adult L2 learners have a more developed L1 system and, therefore, it is more likely to influence their L2 system.

In L2 pronunciation literature, there is a general assumption that the age of learning the target language is more likely to influence the achievement of near-native speaker accent than other aspects of pronunciation like phonological accuracy and comprehensibility (Gilakjani, 2012). Results of studies like James E Flege (1995) and James Emil Flege, Yeni-Komshian, and Liu (1999) have long been used as evidence to argue that the later L2 students start learning the target language, the more likely they will have a detectable foreign accent. The support for such view, however, has been decreasing with empirical evidence showing that the age at which L2 students start learning the target language (Theo Bongaerts, van Summeren, Planken, & Schils,

1997), or the age of arrival to the country of the target language (Mackay, Flege, & Imai, 2006) has no significant effect on L2 students' pronunciation learning.

The role of the CPH is even more limited when L2 learners aim to achieve comprehensible pronunciation (i.e. easier to understand). With the increasing advocation for pragmatic L2 pronunciation learning goals like intelligibility and comprehensibility (e.g. Munro & Derwing, 1995), evidence in L2 pronunciation research has increasingly shown that CPH might slow pronunciation learning but does not halt it. In their narrative review of 75 L2 pronunciation studies conducted with adult L2 students (over 18 years old), Thomson and Derwing (2014) found that explicit pronunciation instruction can have significant learning effects on learners' pronunciation comprehensibility. Similar results were also found with L2 students who arrived at the country of the target language after the age of 18 (e.g. Derwing et al., 2014) where the L2 speakers made significant learning developments in comprehensibility and intelligibility.

Overall, more evidence for the influence of biological age on pronunciation learning and the aspects it influences is needed. While some results in L2 pronunciation research suggest that age of learning can have a negative influence on pronunciation learning (James E Flege, 1995; James Emil Flege et al., 1999), the evidence for such negative influence has mostly affected the level of accent. Meanwhile, a growing body of L2 pronunciation research shows that, while CPH might slow pronunciation learning (especially achieving native-like pronunciation), it does not completely stop it (Gilakjani, 2012). The results in L2 pronunciation research have increasingly shown that the age of learning the target language or arrival to the target language's country can have little effect on their ability to develop their pronunciation comprehensibility and intelligibility (Derwing et al., 2014; Thomson & Derwing, 2014).

2.2 Pronunciation Instruction in the Algerian EFL Classroom

To understand the value of English pronunciation in Algeria and its status in the country's EFL higher education context, it is first necessary to understand the place of English in the Algerian context. Algeria is a north African state covering an area of 2 381 741 square kilometers. The country is bordered by Tunisia and Libya from the east, Morocco from the west, Western Sahara, Mauritania, and Mali from the southwest, and Niger from the southeast. The country's total population, according to the World-Bank (2017) statistics, is 41.31 million distributed around 48 provinces. Algiers is the political and economic capital of the country with a population of 5 million making it the largest city in the country. According to the World-Bank (2016, July 1) list of economies, Algeria is an upper middle-income country mainly relying on Hydrocarbons, like oil and gas, which make 60% of the country's budget revenues and 95% of export revenues.

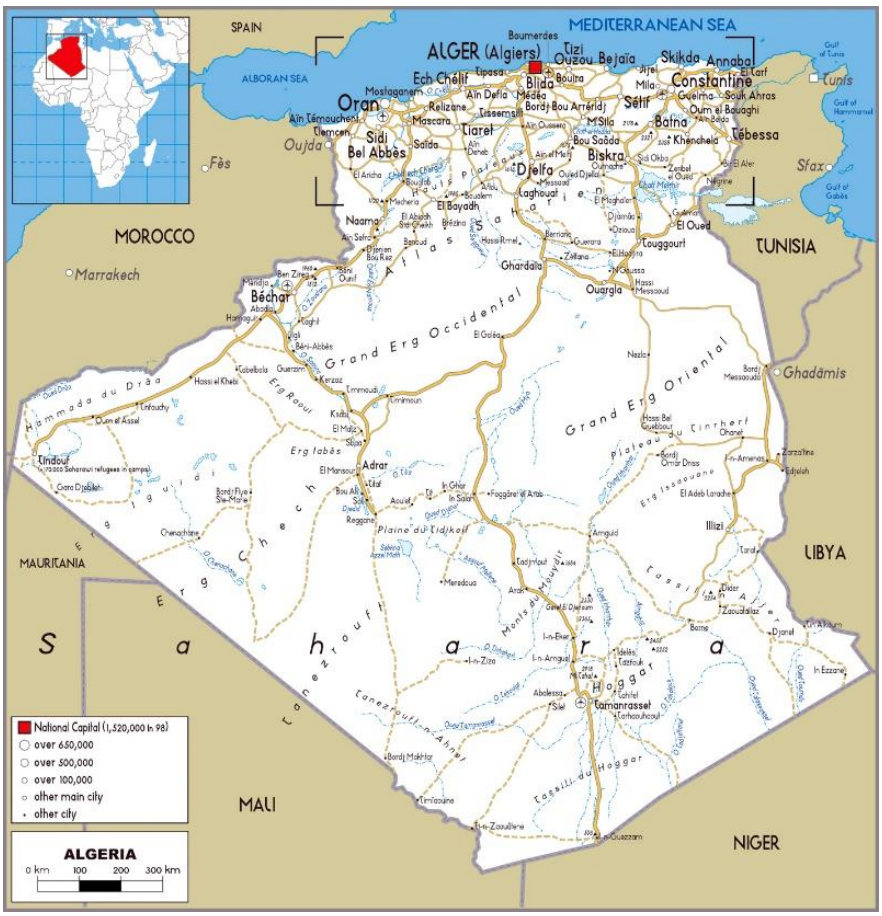


Figure 2.1 Map of Algeria

As far as education is concerned in Algeria, the Ministry of Education and the Ministry of Higher Education and Scientific Research undertook a series of reforms that started since the country's independence in 1962 until the most recent reforms in the early 2000s. Such reforms shaped the basic education into a 12 years process including primary school (5 years), middle school (4 years) and secondary school (3 years) (Bellalem, 2014). Fundamental education in Algeria is free and compulsory for all citizens aged between 6 and 18. The number of students enrolled in schools has increased from a total of 750 000 students in 1962 to total of 8 023 000 students in 2012 (World-Bank, 2014). According to the Unesco statistics (2007), the country witnessed a significant increase in overall literacy rates from 15% just after independence in 1962 to an overall rate of 75.14 % in 2007, 82.62% in the male population and 67.55% in female population. The same statistics show that literacy rates are particularly higher among the population aged between 15 and 24 with an overall rate of 93.77%, 95.75% among the male population and 91.74% among the female population.

At a higher education (HE) level, the Algerian Ministry of Higher Education adopts the Bologna process since 2006 (Benouar, 2013). Such system is known in Algeria through the

French acronym LMD, which is short for Bachelor's degree (Licence), Master's degree (Master), and Doctoral degree (Doctorat). The reason behind adopting the LMD system was, as planned for the Bologna process in Europe during the early 2000s, to create an open and compatible HE system with the international academic community where students and academic work together and collaborate with their counterparts abroad. These HE reforms also gave more flexibility for universities to design their professional and academic programs. With such reforms, the total number of university students has dramatically increased from 2 375 students in one university (University of Algiers) in 1962 to a total of 1 730 000 students distributed over 57 public universities in the academic year 2017/8, 62.5% of which are female students (Bouthelji, 2018).

2.2.1 The Algerian linguistic context and the place of the English language

Due to Algeria's geographical location, ethnic diversity, and long geopolitical history, the country is home to two local languages namely, Arabic and Tamazight and one foreign language, namely French (Benrabah, 2014). All of these languages hold an important historical, social, political, and educational status. With recent educational reformations and an increasingly globalized world, the use of English in this Algerian linguistic context is witnessing an important increase (Belmihoub, 2017). The following section, therefore, represents a simplified attempt to explaining the languages of Algeria, foreign languages in the Algerian education system, and the place of the English language within this linguistic context.

2.2.1.1 Arabic

According to the Algerian constitution, Modern Standard Arabic (MSA) is the official language of the country and is the main language used by all of its government institutions. Despite such official policy, MSA's use is mainly limited to formal settings. Although the language has a strong historical presence, which was further reinforced by the Arabization reforms implemented directly after independence from France, MSA is mainly used in administration, schools, and the media (Maddy-Weitzman, 2012). Far from formal and official settings, Algerians around the country speak a local variety of Arabic commonly known as "Al Darija" and often referred to as "Algerian Arabic" (Saadane & Habash, 2015). This local language mostly employs an Arabic lexical body but is distinguished from MSA with its significant borrowing from the indigenous language Tamazight (see next paragraph) and French vocabulary due to the ethnic and cultural diversity and geopolitical history of the country (Selouani & Boudraa, 2010). Al Darija is the native language of 75% to 80% of the Algerian population and is considered the predominant language within the Algerian society (Ethnologue, 2018). Despite its status within the Algerian society, Al Darija is not officially

taught or used in schools. This is mainly because Algerian policy makers and language planners, as explained in Saadane and Habash (2015), consider Al Darija as an under-resourced language due to its lack of writing resources. Instead, MSA is taught as the first language throughout the educational system (Benrabah, 2005). The basics of the language are taught in primary education where students are expected to have a basic mastery of MSA to be able to read and write. At a high school level, Algerian students, especially those who specialize in languages, are taught MSA at an advanced level and are exposed to classical and modern Arabic literature. MSA is also considered the main language of teaching in fundamental education (primary school, middle school, and secondary school) as it is used to deliver most subjects except for the foreign languages which are always taught in the target language. At a higher education level, however, the use of MSA as an instruction language is limited to the humanities, social sciences, and Arabic studies (Benrabah, 2005). Technical subjects and hard sciences, on the other hand, are taught in French and foreign languages are taught in the target languages concerned.

2.2.1.2 Tamazight

Tamazight, the indigenous language of the Berber population in Algeria, is also an official language in the country. Tamazight, also known as the "Berber language", is a branch of the Afroasiatic language family and constitutes the root language for various Berber dialects spoken in the north African region in general and Algeria in particular (Applegate, 1971, p. 96). Algeria is home to four Berber ethnic groups who speak four different Tamazight derived dialects, namely: Kabyle in the central north region, Chaoui in the Aurès Mountains region located in the north-eastern region, Mozabite in Ghardaia region located in the central north region, and Tamasheq in the Tuareg region located in the southern region. Even though they share the same root language, these Berber dialects vary from one region to another and are sometimes considered by linguists as completely different languages (Maddy-Weitzman, 2012). Tamazight, including its derived regional "dialects", has only been recently recognized by the government as an official language in the constitutional reforms of 2016 after a long campaign by the Berber population for the recognition of their language and culture as part of the country's heritage (Akef, 2016, January 12). However, and unlike MSA, the use of Tamazight in official settings is still limited to few media channels, Berber artists, Berber intellectuals, and political movements due to the lasting influence of former political laws against the teaching and use of this language (Benrabah, 2013, p. 51). The following map demonstrates the local languages spoken by Algerian: (the grey color represents regions that mostly speak "Al Darija").

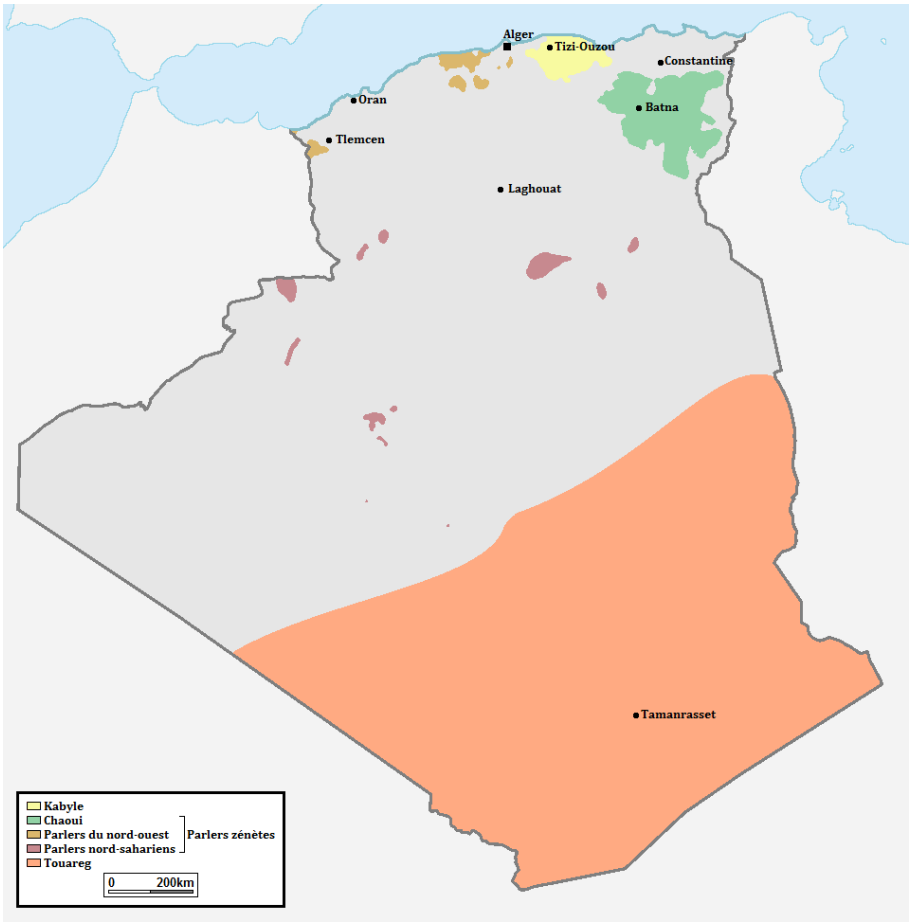


Figure 2.2 Languages of Algeria

As for its education, the language was introduced after the constitutional reforms as an optional subject in schools and is taught as a specialty in higher education (Akef, 2016, January 12; Zehraoui, 2018). In primary and secondary education, the teaching of Tamazigh is mainly focused on the development of basic reading and writing skills. At a higher education level, the teaching of Tamazigh includes its linguistic, historical, cultural, artistic, and political dimensions through specialization. Its use as an instructional language, however, is still limited under the current laws of the Ministry of Education (Maddy-Weitzman, 2012). Despite that, Tamazight is sometimes, used as the language of instruction in areas of the country where Tamazight and its varieties are predominant like Tizi-ouzou, Batna, and Tamanrasset to facilitate the teaching of different subjects to Berber native speakers.

2.2.1.3 French as the first foreign language

French takes the status of the first foreign language in Algeria. Although the language is not official in the country's constitution, it is widely spoken in the Algerian society due to the long and lasting linguistic influence of the French colonialism which lasted from 1830 to 1962 (Benrabah, 2013, p. 21). The strong presence of this language comes in spite of the

"Arabization" reforms implemented by the Algerian government after independence to decrease the use of the "colonizer's language" in official institutions and within the Algerian society (Benrabah, 2005, 2007; Maddy-Weitzman, 2012). Today, the French language is present at both official and social levels. Most governmental institutions in the country translate Arabic and Tamazight documents into French as the first foreign language. Moreover, the French language is especially present among the elites within Algerian society, such as writers, intellectuals, businessmen, and journalists. In educational settings, French is present at both basic and higher educational levels (Benrabah, 2005). In fundamental education, French is the first foreign language introduced to Algerian students at a third-grade level in primary schools and is taught throughout the middle schools and high schools. The language is compulsory and is necessary for passing most educational levels in primary and secondary education. As for higher education, French is considered the language of scientific fields. University programs such as Mathematics, Physics, Biology, and Medical studies are mainly taught using the French language. Besides the lasting influence of colonialism, the use of the French language as an instruction tool in scientific fields has often been attributed to the first post-independence generation of science teachers who were mostly French educated (Benrabah, 2005, 2007). Moreover, the French language, along with Arabic, Tamazight, and English, is also available as a specialty field at different university programs offering specialization in the French language, literature, and Linguistics.

2.2.1.4 English as the second foreign language

With its increasing presence in the country, English has gained an important status in the Algerian context as a foreign language. However, before reaching such an important status, the place of English within the Algerian linguistic scene has fluctuated over the decades due to political and pedagogical reasons. After independence in 1962, the presence of English in Algerian official and social settings has been almost exclusive to schools due to the absence of a historical influence similar to that of the French language. And while the language was introduced to schools during the Arabization era, the textbooks used in schools at the time presented only the structure of the language and attempted to minimize the cultural aspect of the language (Hayane, 1989). Outside of schools, English use during the Arabization era from the 60s to the 70s was limited to oil companies and some governmental institutions dealing with the international community. It was only until the 80s when English started to gain an important place in the Algerian education and society. According to a report conducted by the British-Council (1984), there was an increase in the teaching of English in schools as well as the use in institutions such as media, the Ministry of Defense, and oil companies. The 80s decade also witnessed a notable increase of foreign native and non-native English language speakers

working in Algeria's educational and industrial sectors. Moreover, the Ministry of Higher Education launched scholarship programs for Algerian students in the sciences and languages to go and study abroad. All of this has increased the demand for English language teaching and learning in Algeria.

Such interest in English, however, slowed down during the 90s because of a decade of political unrest and a civil war that lasted 10 years (Bellalem, 2012). This has led to a period of instability in the education sector where the development of English language teaching programs, along with other programs, was slowed down significantly. For example, the plans for introducing English in 1993 as an optional language in primary schools failed due to poor management, and refusal of most parents. Moreover, most of the already few English language teachers from abroad left the country. By the end of the civil war, however, the interest in learning and speaking the English language has reemerged (Belmihoub, 2017). Such interest has been mainly fueled by globalization factors, particularly with the democratization of internet in the late 90s and early 2000s and a spread of American media productions subtitled with Arabic in the Arab world. A survey conducted by Benrabah (2014) involving 204 university student of language showed that 92% of Arabic, French, and English students regard English as the main global language. Such popularity of the English language among Algerian students, as explained by the author, can be mainly attributed to the absence of a negative historical memory toward this language unlike the case of French, which is often associated with colonialism by Algerian society.

In educational settings, English was introduced to Algerian schools since independence and was taught starting from the eighth grade. After the education reforms in 2000, English is now taught starting from the sixth grade in middle school (Benmati, 2008). At this level, students are taught the basic four skills of the language and are expected to be able to read and write at a beginner level by the end of high school. At a higher education level, English does not retain a status similar to that of the French language as very few scientific fields in higher education use it. On the other hand, English language learning and specialization programs are offered in most universities around the country (Nadia, 2011). Most BA English programs at the university offer two years of advanced language learning and a year of specialization in English language literature, English for specific purposes (ESP), and Applied linguistics. Further specialization in such fields is also offered at Master and Doctoral levels.

The teaching of English in Algeria, however, faces various pedagogical challenges that affects its quality negatively. According to Miliani (2001), the teaching of the English language in Algeria lacks two fundamental basis: the availability of input and opportunities for practice.

While input in Arabic (MSA) and French can be easily accessible, English materials in and out of schools, given to its only recent increased use, are scarce and expensive. Therefore, Algerian EFL students find themselves in a situation where they are too reliant on the internet or media to access input in the target language. Additionally, the Algerian linguistic context offers limited opportunities for practicing English outside the classroom. Unlike Arabic and French speakers, EFL students in Algeria rely only on the classroom and language clubs (if available in their city) to practice the target language. This issue, according to Miliani (2001), is even deeper when considering that Algerian EFL student rarely use the target language when practicing together. As a result, the statistics provided by Euromonitor (2012), for example, show that the overall English language level of Algerian EFL students is lower than in neighboring countries like Egypt, Tunisia, and Morocco. Such limitations posed for the teaching of English in Algeria are usually blamed on the top bottom approach implemented by policy makers in the field of education (Benrabah, 2014; Miliani, 2001). Such approach lacked planning and considerations for the nature of the linguistic context before introducing English to schools and universities.

2.2.2 The value of English pronunciation in the Algerian context

In the Algerian context, and to meet the increasing demand for communicative competence from EFL graduates in the job market, EFL university programs in the country have recently started giving more attention to pronunciation (Belmihoub, 2017; Nadia, 2011). In jobs where English oral communication is necessary (like teaching, journalism, or translation), such demands are particularly present as EFL graduates are expected to have at least a comprehensible pronunciation. Under such circumstances, poor pronunciation can significantly affect the job prospects of Algerian EFL students. To meet such demands, EFL programs around the country started to tackle pronunciation through two main modules: Phonetics and Oral Expression (Sonia & Abdelkader Lotfi, 2016b). The Phonetics module is designed to introduce EFL learners to the phonological inventory of the target language. Instruction in such module is centered around learning the pronunciation of single sounds and diphthongs by listening to the teacher or listening to native speaker models in pronunciation labs. The practice and assessment of learning in such module is often conducted using phonetic transcription activities where students transcribe a written text from or into the International Phonetic Alphabets (IPA). The Oral Expression module, on the other hand, takes a communicative approach in tackling the speaking skill whereby the focus is on giving EFL students opportunities to use the language and communicate effectively (function) instead of the traditional focus on form. To achieve this goal, the module provides opportunities for EFL learners to practice their pronunciation through different activities which simulate everyday communication like: debates, plays, and presentations (Chergui, 2016). In such activities,

Algerian EFL students are evaluated on the extent to which they are able to communicate their ideas effectively.

2.2.3 The challenges of prosody instruction in the Algerian EFL classroom

Despite the positive attitude towards pronunciation in the Algerian EFL context, its teaching in EFL university programs is mainly focused on phonemic features while prosody features are often neglected (Fethi, 2016; Sonia & Abdelkader Lotfi, 2016b). To investigate this pronunciation instruction issue in Algerian EFL university programs, Fethi (2016) looked at the attitudes of 60 Algerian EFL teachers towards the teaching of pronunciation through semi-structured questionnaires. The results of the study showed that 90% of the surveyed teachers preferred the teaching of phonemic features over prosody features. When brought up in Algerian university EFL programs through the Phonetics module, pronunciation instruction is mainly dedicated to the development of EFL students' perception and production of individual sounds in the target language (Sonia & Abdelkader Lotfi, 2016b). Students are mainly introduced to such features through decontextualized input (oral and written) and their understanding is tested through phonetic transcription activities. In the Oral Expression module, prosody features, as phonemic features, are broadly addressed through teacher comments about students' pronunciation during communicative activities without explicit instruction.

Such phonemic based pronunciation instruction, and while it is necessary for students' phonological intelligibility and comprehensibility, marginalizes prosody features which are found to be another crucial pronunciation component that positively correlates with EFL speech's comprehensibility along with other linguistic features such as grammatical accuracy and speech fluency (Derwing & Munro, 1997; Saito et al., 2016) (see **Chapter 2**, Section 2.1.3 for more details about the role of prosody in EFL speech comprehensibility). Consequently, the lack of focus on prosody is particularly damaging for Algerian EFL learners who are found to have major difficulties with the use of prosodic features and require overall comprehensibility as a minimum requirement for jobs in which oral communication is necessary (Sonia & Abdelkader Lotfi, 2016b). To highlight the importance of prosodic instruction for the comprehensibility of Algerian EFL learners, Sonia and Abdelkader Lotfi (2016b) engaged 30 EFL students from the University of Oran to take part in oral expression courses which tackled prosody features stress and intonation. Students' pronunciation output was recorded before and after the study, and then analyzed using Praat. Findings, and in accordance with pronunciation literature in international settings (e.g. Kang, 2010; Munro & Derwing, 1995; Saito et al., 2016), showed that exposure of Algerian EFL students to prosody practice helped in significantly enhancing their pronunciation comprehensibility in spontaneous and controlled speech.

When looking at the reasons behind the marginalization of prosody features in the Algerian EFL classroom, the Algerian EFL pronunciation literature, like that of other EFL contexts around the world (e.g. Breitkreutz, Derwing, & Rossiter, 2001; Buss, 2016; Foote, Trofimovich, Collins, & Urzúa, 2016), found that the challenges facing the teaching and practice of prosody are mainly attributed to a lack of teacher training, lack of input, lack of practice opportunities, and lack of personalized corrective feedback (Fethi, 2016; Miliani, 2001; Sonia & Abdelkader Lotfi, 2016b). According to the L2 and EFL pronunciation literature, such limitations to the teaching and practice of prosody are directly related to the most influential factors affecting L2 pronunciation teaching and learning. The following three sections discuss the negative influence of such limitations of prosody teaching and practice in the Algerian EFL classroom on students' pronunciation comprehensibility (the aspired goal) in relation to the L2 and EFL pronunciation literature.

2.2.3.1 The lack of teacher training and specialized practice materials

In the second part of Fethi's (2016) study which highlighted a predominant emphasis on phonemic pronunciation by 90% of the Algerian EFL teachers, the study asked the teachers about the reasons for not addressing prosody features in their pronunciation activities, most of the teachers attributed their choice to the lack of necessary training and practice materials. In their reports, most of the teachers admitted that they did not receive specialized pronunciation training that allows them to deliver training sessions about prosody in an explicit and a systematic way. This lack of explicit instruction about prosody can be particularly damaging for students' perceptions of such features and their influence on meaning in English pronunciation. In case where EFL teachers attempt to address prosody, the lack of teacher training can lead teachers to address them in uninformed way that rely on teachers' intuition (Derwing & Munro, 2005). One particular downside of such uninformed approach to the teaching of prosody is setting unrealistic native-like pronunciation goals for Algerian EFL learners which can be damaging for the motivation of students who can't attain it.

The problem of the lack of informed explicit prosodic instruction is even further complicated with the scarcity of EFL prosody teaching textbooks and practice materials (Fethi, 2016; Miliani, 2001). Similar to other EFL contexts around the world, Algerian teachers are faced with the challenge of accessing materials that can supplement their lessons about prosody with research informed activities. While some materials are often available in university libraries, the access to the already few copies is difficult due to high demand from teachers and students. Moreover, Algerian EFL teachers often describe the pronunciation teaching labs in their universities to be outdated and lacking dedicated material for prosody as they employ

audio-tapes where students only listen to the speech models of isolated words and utterances with no meaningful opportunities to practice or receive feedback on their pronunciation. This lack of exposure to prosodic input can negatively affect Algerian EFL learners' perceptions of such features (Sonia & Abdelkader Lotfi, 2016b). With the lack of real examples on the use of stress and intonation, students won't develop a sense of how such features influence meaning, and in turn, this can negatively affect students use of such features.

2.2.3.2 Insufficient practice opportunities

As a result of the lack of explicit prosody instruction, few prosody focused practice opportunities are offered in the two modules where pronunciation is addressed in Algeria university EFL programs (Phonetics and Oral Expression modules). In the Phonetics module, and while the phonetic transcription activities can be very effective in developing students' perceptions of individual sounds (e.g. Barker & Torgesen, 1995; Wang & Munro, 2004), it has little to offer for students' perceptions of the prosody features. Additionally, the phonetic transcription activities are mostly conducted in a written format to give students an equal chance of participation (Sonia & Abdelkader Lotfi, 2016b). This, however, limits the chances of students to practice their pronunciation through controlled or spontaneous speech that might address students use of prosody. The Oral Expression module, on the other hand, offers students the chances to produce spontaneous speech that can address the use of prosody incidentally. The likelihood of prosody focused practice, however, is limited due to the lack of specialized teacher training and practice materials. Consequently, the broad comments (or recast) provided by the teacher, and while it can be helpful in correcting some mistakes, can be limited in raising students' awareness of prosody. With such limitations of prosody practice, it is also important to remember issues of the teacher-centered classroom, as highlighted in Levis and Grant (2003), and time restrictions, as highlighted Neri, Cucchiarini, Strik, et al. (2002), which are also found in other EFL contexts around the world when addressing pronunciation.

This lack of practice opportunities, according to the L2 pronunciation literature, is damaging as it prevents students from working on their use of prosody features, discovering their difficulties, and working on them (Neri, Cucchiarini, Strik, et al., 2002). This is particularly true in a context like Algeria where the use of English outside the classroom is very limited. Advocators of practicing output in the L2 literature, such as Swain (2000) and Long (1996) see practice as an opportunity through which students' can identify the gaps in their output. In prosodic pronunciation practice, identifying such gaps can be done by comparing between how the students wants to (or is hoped to) pronounce a word or a sentence, and how they were able to say it. In a classroom setting, the identification of gaps can be done by the

student himself, their teacher, or with the help of classmates and is very helpful in raising students' awareness of their pronunciation problems.

2.2.3.3 Limited corrective feedback

Another limitation facing the practice of prosody features in the Algerian EFL classroom is the scarcity of comprehensive and corrective feedback on EFL students' pronunciation output in the EFL classroom (Fethi, 2016). Due to the lack of specialized pronunciation training and materials, Algerian EFL teachers may find it challenging to systematically evaluate the use of prosody features through meaningful lessons and activities. Consequently, such features are either not addressed (as in the Phonetic module) or are often dealt with through broad comments (mostly recast) on students' use of stress, intonation, and sentence rhythm (as in the Oral Expression module). However, with the lack of training, such comments risk misinforming students about their actual pronunciation problems and therefore hindering students' pronunciation learning (Baker & Murphy, 2011). This can be particularly damaging if the teacher set pronunciation goals that can be challenging to achieve for students such as the native speaker principle instead of pragmatic goals such as intelligibility and comprehensibility. This lack of corrective feedback in pronunciation practice comes in spite of evidence highlighting the importance of corrective feedback raising students' awareness of their pronunciation problems (e.g. A. Lee & Lyster, 2016; Saito & Lyster, 2012) (see **Chapter 2,** Section 2.1.4 Factors affecting pronunciation teaching and learning). As they keep practicing without receiving informed and personalized corrective feedback on their use of prosody features, Algerian EFL students face the challenge of fossilization as they keep making similar mistakes.

2.2.3.4 Psychological pressure

Another factors that can also negatively affect the teaching and practice of prosody in the Algeria EFL classroom is the psychological factor. To investigate this issue in the Algerian EFL classroom, Melouah (2013), looked at the issue of anxiety among 54 first year EFL university students at the University of Blida during oral activities. The study attempted to investigate the levels of anxiety among EFL students and its source using semi-structured questionnaires. The results of the study showed that anxiety is very prevalent among Algerian EFL students during oral activities. According to the participants, such anxiety mainly stemmed from a fear of interaction in the classroom, error correction (fear of judgement), and low self-confidence in language level. Even if prosody is tackled in the classroom, such circumstances might negatively influence students' willingness to take part and work on their pronunciation. The classroom environment can often be seen by EFL students as hostile because of their teachers and peers judgement of their oral output (Neri, Cucchiarini, Strik, et al., 2002). Such judgmental

environment could be stressful for students, especially those with low confidence about their language level, and make the decision of sharing their output in the classroom very challenging. For example, a large-scale survey of up to 579 Chinese EFL students from different disciplines by Peng and Woodrow (2010) showed that classroom environment was a strong predictor of students' willingness to take part in oral activities. Consequently, the psychological pressure can add more limitations to the practice time in the EFL classroom.

2.3 Computer-Assisted Pronunciation Training as an Alternative Environment

Given to the pedagogical limitations facing prosodic pronunciation practice in the Algerian EFL classroom (which led to its marginalization), ASR based CAPT technology can be integrated as an alternative environment. In accordance with the policy of the Algerian Ministry of Higher Education and given the reality of the Algerian EFL context and resources available, ASR based CAPT represents an easy to learn and an affordable technology. Such technology has the potential to compensate for the lack of teacher training and materials designed for prosodic practice in the Algerian EFL classroom through its audio-visual representations of such features, self-paced practice, and immediate personalized feedback. The current subsection introduces the design of CAPT technology, explain how it fits in the Algerian higher education EFL context, and how it can serve as an alternative for prosody practice to avoid the current pedagogical limitations.

2.3.1 The technical architecture of ASR based CAPT technology

Computer-assisted pronunciation training, also abbreviated as CAPT, refers to the use of computer technologies in desktop as well as portable devices to practice pronunciation. In computer-assisted language learning (CALL) literature, the term CAPT can refer to the use of different computer programs that can be used for pronunciation training or to those which employ automatic speech recognition (ASR) for pronunciation training purposes. The first use of the term CAPT refers to computer programs that offer opportunities for receiving speech input and practicing pronunciation output. These types of computer programs were not originally designed for pronunciation training but can be used in pronunciation instruction or practice. Such programs can include, and are not limited to, the use of speech recording and editing platforms (e.g. Stenson et al., 1992), computer-mediated communication (CMC) platforms (e.g. Alastuey, 2010), and audio sharing platforms (e.g. Ducate & Lomicka, 2009). The latter use of the term CAPT, on the other hand, refers to ASR based CAPT systems which make use of speech recognition and visualization technologies to offer explicit and self-paced pronunciation training with personalized feedback and a free stress environment (Neri, Cucchiarini, Strik, et al., 2002). The current study focuses primarily on CAPT programs that use

ASR technology (Aka ASR based CAPT). The reason behind focusing on ASR based CAPT programs is that their design offers an alternative pronunciation training environment that tackles the issues that arise in the Algerian EFL classroom, as discussed in the previous section. The following figure illustrates an example of the user interface of the ASR based CAPT technology Tell Me More (More details about the ASR based CAPT system used in the current study are presented in the Methodology chapter).

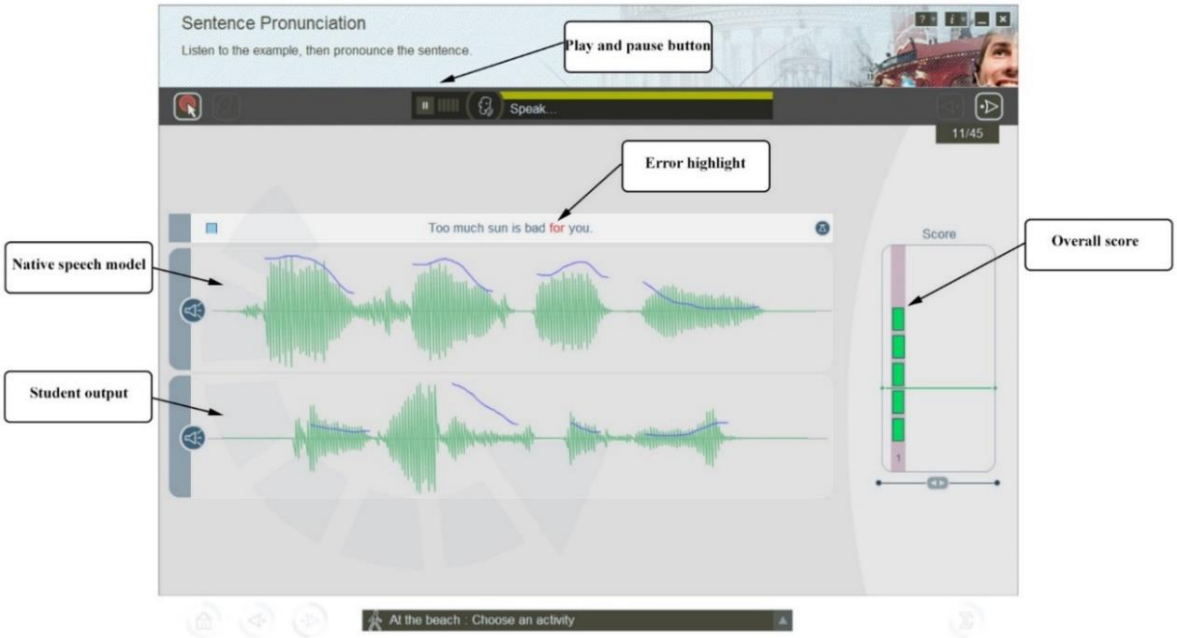


Figure 2.3 The user interface (UI) of ASR based CAPT systems

The design of ASR based CAPT programs can be divided into three main processes: 1) speech recognition, 2) speech processing, and 3) speech evaluation and visualization (Witt & Young, 1997). The first process relies mainly on automatic speech recognition (ASR), which is an algorithm programmed to decode oral linguistics messages and to input the student's oral output into the program. During this phase, the ASR system receives the oral output via the microphone and encodes it into the program's language. Once the oral output of the student is uploaded into the system, the speech processing phase starts. At this stage, the transcription of the output is compared to an inbuilt model that is often recorded by a native speaker. Based on this design, the more student's output is similar to the model, on both segmental and suprasegmental levels, the higher feedback will be. This leads to the evaluation and visualization phase whereby students' output is scored, visualized with soundwaves, and compared to the model. The following figure provides a simplified illustration of the technical processes in ASR based CAPT programs.

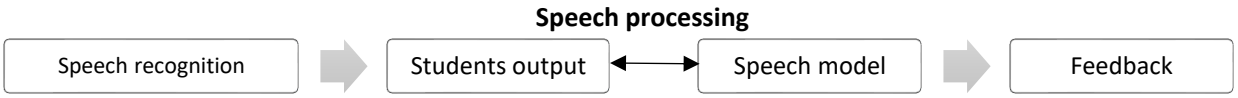


Figure 2.4 The technical processes of ASR based CAPT systems

Today, ASR based CAPT programs are available on both desktop and portable computer devices and can be purchased or downloaded freely on different operating systems for different language levels. Bajorek (2017), for example, reviewed CAPT systems targeted for desktop computers, such as Rosetta Stone's Tell Me More, and others targeted for mobile devices, such as Duolingo and Babble. Most of these systems share their attempt to provide a simplified user interface (UI) for students to facilitate their pronunciation practice with the processes explained previously. The speech recognition process is often represented by a red record button. The speech processing is often represented by a comparison between the soundwaves of the student and the model. The speech evaluation process is represented by the final score and, sometimes, a red highlighting of segmental or suprasegmental errors.

2.3.2 The place of ASR based CAPT technology in the Algerian EFL classroom

Along with the reformation of the teaching approaches, the educational reforms implemented in Algeria during the early 2000s advocated for the integration of new technologies in the educational institutions throughout the country (Nadia, 2011). This policy led to an important increase in the budgets of educational institutions so that they can afford at least one IT room in each school or faculty at a university level (Tawil, 2006). The policy was particularly implemented by the end of the last decade and was facilitated by economic growth. On an administrative level, such policy was meant to digitize educational institutions to facilitate the admission and communication with students while eliminating bureaucratic hurdles. On an educational level, the integration of technology was hoped to facilitate the teaching and learning of the different subjects. The integration of new technologies was meant to support the language classroom in general and the EFL classroom in particular. Research records of using technologies in the Algerian EFL context indicate an emphasis on providing students with authentic input in the target language (Bedjou, 2006). Such use of technology focused particularly on learning vocabulary and developing the listening skill due to its easier fit in the traditional language classroom. Common trends of technologies in the Algerian EFL classroom include activities for vocabulary learning using films and videos (e.g. Bouzenoun, 2018), writing activities (e.g. Boutkhil, Celllali, & Ibtissam, 2016), and fill in the blanks activities for listening using audio recordings or music (e.g. Bedjou, 2006).In pronunciation teaching, however, the use of such resources (primarily IT rooms) remains limited due to the lack of teacher training. Despite the availability of pronunciation labs in some institutions, many

teachers avoid using them due to their limited features (only listening) and prefer focusing on phonetic transcription activities.

With the current resources available in Algerian schools and universities that provide EFL programs, ASR based CAPT represents a technology that can be easily integrated into the Algerian EFL context. Such technology, as highlighted in (Bajorek, 2017), is available on a variety of desktop and portable computers, smartphones, and tablets. This makes CAPT a flexible technology to be integrated into the IT rooms or through other technological means available in Algerian institutions. Such integration is even easier when considering the fact that many ASR based CAPT programs and applications are available for free (e.g. MyET on PC and Duolingo on smartphones and tablets). This gives institutions the freedom to choose from CAPT programs that meet their budget. In addition to the flexibility of its integration, ASR based CAPT programs are characterized by their user-friendliness (O'Brien et al., 2018). In other words, CAPT programs are mostly characterized by a simplified user interface (UI) that makes it easy for teachers who don't have a long experience with new technologies to learn and use them in their classes. The use of CAPT platforms is also facilitated by a considerable research literature on the characteristics and use of such technology for pronunciation practice (Levis & Grant, 2003). This can help Algerian EFL teachers to understand the process of such technology, its potentials, and how it can be integrated into teaching and practicing prosody.

2.3.3 The effectiveness of CAPT of prosody with EFL learners

This section provides research-based evidence on the potential contribution of ASR based CAPT technology to the teaching and practice of prosody in the Algerian EFL classroom. With their unlimited input, self-paced opportunities for practice, and personalized feedback, ASR based CAPT systems provide a promising alternative for pronunciation training and has the potential to compensate for the limitations facing prosody teaching and practice in the Algerian EFL classroom (Neri, Cucchiarini, Strik, et al., 2002). The continuous evolution of these technical features in ASR based CAPT systems and the growing pronunciation literature advocating for the importance of prosody features for EFL students' pronunciation comprehensibility (e.g. Kang, 2010; Munro & Derwing, 1995; Saito et al., 2016), motivated L2 pronunciation researchers to empirically assess the effectiveness of CAPT of prosody. Such a trend in pronunciation literature employed a common empirical procedure whereby EFL students are enrolled in CAPT to practice prosodically rich utterances for a defined duration that is preceded and followed by pronunciation learning tests. The following section summarizes and critically reviews this CAPT literature. The studies discussed in this review are mainly conducted with EFL students and some studies with other L2 students (non-ESL/EFL) with a

focus on the practice of prosody, namely: stress and intonation. Such selection criteria for the reviewed studies were established to focus on studies that are relevant to the Algerian EFL population with whom the current study was conducted.

2.3.3.1 Prosodic input

In comparison with the traditional classroom and pronunciation labs available in the Algerian context (Miliani, 2001), ASR based CAPT has a richer inventory of audio-visual input which presents prosody features in a more meaningful way. As opposed to the isolated words and sentences presented by the teacher or the traditional pronunciation labs in the Phonetics module, CAPT systems address pronunciation explicitly and provide divers and contextualized audio-visual input (often recorded by native speakers) of sentences that represents English prosody stress, intonation, and rhythm (Pennington, 1999). This is through audio recorded declarative, interrogative, and expressive statements that are presented within a variety of real-life topics and stories. These audio models of English prosody are also often facilitated with visualization features that vary from one CAPT technology to the other and usually include: phonetic transcriptions, soundwaves, pitch contours (Aka pitch tracking), and 2D image or a 3D simulation of articulation highlighting the essential speech organs for pronouncing segments or utterances.

The development of such technical ASR features increased the interest of L2 pronunciation researchers to study their potential in teaching and practicing prosody features. This is what motivated Anderson-Hsieh (1992), to provide an early detailed analysis of English prosody features, namely, stress, rhythm, linking, and intonation and explained how such features could be taught and practiced effectively through the visual representations and feedback of CAPT systems. The article employed the speech recording and treatment software Visi Pitch as an example and concluded that the visual side of the technology provides a great benefit for EFL students to understand suprasegmental features. Similarly, Chun (1998) highlighted the potential of ASR based CAPT systems in teaching intonation and particularly emphasized on the value of extensive authentic audio input and the role of pitch tracking as the main intonation visualization features. In a comprehensive review of the technical features of ASR based CAPT systems, Levis (2007) particularly acknowledged the potential positive role of the audio-visual input in raising students' prosodic awareness and accuracy and called for more empirical evidence to further highlight their importance.

The popularization of such features and their integration in ASR based CAPT systems during the late 90s motivated L2 pronunciation researchers to provide research-based evidence on the effectiveness of CAPT's audio-visual input in developing EFL learners' understanding

and awareness of suprasegmental features. To do this, Ramírez Verdugo (2006), for example, explored the effectiveness of CAPT in developing the intonation awareness among Spanish learners of English. The study recruited two experimental groups of 10 adult Spanish learners of English and a group of 10 adult native English speakers. The first experimental group enrolled in 10 weeks of prosodic pronunciation practice using the ASR based CAPT system Speech Analyzer, while the second experimental group engaged in the same training but in the traditional classroom. All of the participants in the two experimental groups were given an introduction into prosody features, meanwhile, only the first experimental group was given an introduction to intonation representation in CAPT. The study employed questionnaires and spontaneous speech recordings to measure the development in participants' intonation awareness. The results of the study showed that the participants engaged in CAPT made significant development in their perception and production of English intonation. According to the author, the contextualized audio-visual input and the simplicity of the intonation direction indicators helped EFL learners in improving their perception of intonation and its influence on meaning in speech.

In a long-term empirical study, Tanner and Landon (2009) investigated the effectiveness of CAPT in developing ESL learners' awareness of pausing, stress, and intonation to enhance the overall comprehensibility of ESL learners. 75 participants from mixed L1 backgrounds were randomly recruited and divided into an experimental group using CAPT individually and a no-treatment group serving as a control group. The participants in the experimental group were engaged in 11 weeks of individual practice with the ASR based CAPT system Cued Pronunciation Reading (CPRs). Activities in this group involved oral reading of prosodically rich sentences that contained different uses of pausing, word stress, and intonation. To measure students' prosodic awareness development, the author employed syllable and word stress identification and intonation direction activities. Participants were also asked to complete a survey addressing their perceived usefulness and perceived ease of use of the CAPT system. The prosody perception results of the study showed that participants using the CAPT system made significant developments in their awareness of the practiced prosody features, especially with sentence stress. As for the survey results, the participants in the treatment group, despite acknowledging the need for more practice, felt that they made progress. According to those participants, CAPT increased their awareness of English pronunciation by visually highlighting pause and stress in the activities. In terms of use, two major difficulties were reported on the perception activities, namely: identifying stress and understanding the native speaker models. In terms of production activities, the participants reported facing the challenge of imitating the speech models.

In another study, Bahman Gorjian, Abdolmajid Hayati, and Parisa Pourkhoni (2013) investigated the effectiveness of Praat, a speech recording and analysis software that uses the same speech visualization features to that of ASR based CAPT systems, in teaching English prosodic features. The study enrolled 40 adult intermediate Iranian EFL learners in 10 CAPT sessions focusing on stress and intonation. The participants in this study were equally divided and randomly assigned into two groups of 20: an experimental group and a control group. In the experimental group, the prosodic features were taught using the visual illustrations of Praat. Meanwhile, the same prosodic features were taught in the traditional classroom with the control group. All of the participants sat for a pre-test and a post-test to measure their understanding of stress and intonation in English pronunciation. The results of the tests demonstrated that the participants who practiced with Praat made significantly more development in their understanding and awareness of syllable stress, sentence stress, and intonation than the traditional learning group. According to the author, the CAPT group made the most learning developments because the prosodic visualization tools in Praat are more accurate and personalized than the traditional tools available for the teacher in the normal classroom.

Jolley (2014) looked at the impact of ASR based CAPT practice in developing the perception of prosodic features with 13 adult EFL learners from a variety of L1 backgrounds. The study engaged the participants in 10 weeks of prosodic practice with the ASR based CAPT system Cued Pronunciation Readings (CPRs) focusing mainly on stress, pausing, and intonation. Participants prosodic awareness development was measured through listening tasks where participants listened to prosodically rich texts and were asked to identify the placement of stress and pausing, and the direction of the final intonation. The final results of the study showed that the participants engaged in CAPT made significant developments in their awareness of the different practiced prosody features. According to the author, the technical features of CPRs helped students in visualizing the prosodic features and understanding their influence on meaning which could positively influence their pronunciation intelligibility on the long term.

More recently, Hsu (2016) evaluated the relationship between EFL students learning styles, the perceived ease of the audio-visual input in CAPT, and the perceived usefulness of CAPT. In this study, 341 Taiwanese EFL students took part in a self-regulated pronunciation training with the ASR based CAPT system MyET for three months. Data about the perceptions of students were collected using a structured questionnaire. Overall, the results showed that visual and kinesthetic learning significantly influenced learners' perceived ease of use and consequently their perceived usefulness of the CAPT system. The visual style was triggered by the speech visualization features of CAPT like feedback; meanwhile, the kinesthetic learning

style was positively influenced by the interactive nature of using MyET by playing, recording, and replying the speech models. The findings of this study also confirmed the correlation between the positive perceived ease of use and positive perceived usefulness of CAPT. In other words, the more students found the program's input and its visualization features easier to use, the more their perception of its usefulness on their pronunciation learning practice increased.

Overall, ASR based CAPT systems provide an innovative approach to the teaching and practice of supra-segmental features thanks to the technology's audio signals of the different prosodic features and their visual representations (e.g. Anderson-Hsieh, 1994; Chun, 1998; Levis, 2007). More importantly, such audio signals and visual representations were found to have a significantly positive effect on EFL learners' understanding and awareness of prosody features (e.g.B. Gorjian, A. Hayati, & P. Pourkhoni, 2013; Jolley, 2014; Ramírez Verdugo, 2006; Tanner & Landon, 2009). However, the literature also highlighted some of the drawbacks in visual representation of prosody in CAPT systems. Anderson-Hsieh (1994), for examples, highlighted some limitations in the audio signals provided in some CAPT systems pointing out that they often fail to simulate real-life spontaneous speech. In terms of visual representations, Levis (2007), suggested that spectrograms, unlike the intuitive soundwaves and intonation indicators (pitch tracking), may be too challenging to interpret by learners. It is, therefore, recommended that the teachers who decide to use CAPT carefully choose the system and provide a complete introduction on its prosodic visual representations to the students prior to the training.

2.3.3.2 Self-paced practice opportunities

Moreover, and while EFL learners benefit from few opportunities to practice prosody in the Algerian EFL classroom (Fethi, 2016; Sonia & Abdelkader Lotfi, 2016b), ASR based CAPT platforms offer unlimited and self-paced sentence pronunciation activities (Neri, Cucchiarini, Strik, et al., 2002). Depending on the platform, CAPT activities vary from simple listen and repeat, to listen and choose the correct answer, or free speech activities (Yu et al., 2016). Such activities present an important chance for Algerian EFL students to expand their prosody practice time as activities can be paused, repeated, or resumed based on students' satisfaction with their pronunciation level. Unlike the limited chances in the traditional classroom, such self-paced practice can help Algerian EFL students to detect and work on their own pronunciation problems. Moreover, it gives them the decision to move to practice other words or sentences and, therefore, they are not pressured by the limited practice opportunities as in the traditional classroom.

Such features motivated L2 pronunciation researchers to investigate the effectiveness of CAPT's self-paced practice and its various activities in developing the prosodic accuracy of L2 and EFL learners. In fully automated CAPT studies, students are exposed to the technology with little or no introduction to the technology and are expected to practice with it alone and at their own pace. An example of such studies is that of Hincks (2003) who investigated fully automated individual CAPT with 11 middle aged immigrants in Sweden studying English. Participants were given a copy of the CAPT program Talk to Me and were asked to practice at home while keeping a record of their practice time for ten weeks. The study employed the online pronunciation test Phonepass to measure students' overall pronunciation development (phonemic and prosodic). The results of this study showed that unlimited access to CAPT was beneficial for participants who started with a heavy accent but was limited to students who started with better pronunciation. Such results suggest that the self-paced practice gave the participants with the most pronunciation problems a chance to work on them.

Influential studies on the effectiveness of individual self-paced practice of prosody with CAPT also include some non- ESL/ EFL studies. Hardison (2004), for example, conducted two experiments to evaluate the effectiveness of individual computer-assisted prosody training with native English speakers of French. To do this, 16 participants took part in 13 sessions of sentence pronunciation training focusing on pitch, stress, and intonation using the ASR based CAPT system Kay Elemetrics Computerized Speech Lab (CSL). Students' pronunciation output was recorded during the pre-test and post-test phases of the study and assessed by expert French language teachers in terms of prosody use. The pronunciation assessment results of the study showed that students made a significant pronunciation learning development in terms of their use of the practiced prosody features. Such learning progress, according to the author, was likely a result of the rich and contextualized activities that simulated various uses of stress and intonation.

Other trends of research focusing on prosody practice with ASR based CAPT systems were also interested in accent reduction. The rise of this research trend came as a result of the rise of pronunciation research interested in immigration and integration issues (Derwing & Munro, 2015). Seferoğlu (2005), for example, researched the effectiveness of self-paced pronunciation practice with the CAPT system Pronunciation Power in reducing accent for adult Turkish speakers of English on segmental and suprasegmental levels. 40 adult EFL students (aged between 20 and 24) from the Department of Foreign Language Education were equally and randomly assigned to two groups. 20 in an experimental group using the CAPT system individually and 20 in the control group followed regular classroom instruction. The training lasted three weeks and included prosody features practice. With a high inter-rater reliability

value of 0.90, pre-test and post-test results showed no significant pronunciation learning differences. However, the mean results showed a slight pronunciation development by the students in the experimental group.

In a study that looked at the link between the pedagogy and technology of CAPT, Tsai (2006) investigated the perceptions of nine junior college EFL students (Chinese L1) with varying language levels: beginner, intermediate, and advanced. The participants took part in three CAPT sessions a week for two weeks using the online CAPT system MyET to practice prosody features through sentence pronunciation activities. To explore students' perceptions, the author employed semi-structured questionnaires and interviews by the end of the training. The results of the study indicated that students particularly liked the autonomous and self-paced nature of CAPT. Participants reported that they enjoyed practicing at their own pace while receiving individualized immediate feedback as it allowed them to work on their pronunciation problems. With such positive perceptions, participants also provided negative reports towards the "listen and repeat" activities which they sometimes found to be mechanical. Furthermore, participants also criticized the grading system which compared their output with native speech models that they often found difficult to imitate and keep up with their speed.

In an empirical study focusing on prosodic practice, Chiu et al. (2007) investigated the extent to which the individual use of the web-based CAPT system *Candle Talk* would enhance the pronunciation comprehensibility of Taiwanese speakers of English. A total of 49 students, 29 of which were English majors and 20 non-English majors, took part in a training that lasted six weeks and revolved around sentence pronunciation activities addressing prosody features. Students' pronunciation was recorded in pre-tests and post-tests and evaluated by listeners based on a five points scale of comprehensibility (1 = incomprehensible, 5 = easy to understand). The study also looked into students' perceptions towards the ASR based CAPT system with a structured evaluation questionnaire that was handed to the participants after the study containing 21 items focusing on the perceived use and effectiveness of the CAPT system. The pronunciation results of the study showed that the participants engaged in CAPT of prosody for six weeks made significant pronunciation learning development as measured through their overall comprehensibility results. In terms of students' perceptions towards the technology, the questionnaire results showed that the participants held positive perceptions about ASR based CAPT, despite having a short experience with such technology before the study. Participants especially appreciated the activities that revolved around topics from the target culture using native speech models. Moreover, they regarded feedback as the second most useful feature during the training. On the other hand, failures of the speech recognition system were perceived negatively as it slowed the practice down and made it more repetitive. Although, the authors

pointed out that such failures, in some cases, are a result of participants not responding to feedback after mispronouncing a segment.

Liu and Hung (2016) investigated the effectiveness of sentence pronunciation practice in CAPT with 51 adult EFL learners from different vocational colleges and universities in Taiwan. The study enrolled the participants in eight weeks of pronunciation instruction focusing on segmental and prosodic features (namely: intonation and stress) using the online ASR based CAPT system MyET. Participants were given a brief introduction about the segmental and suprasegmental components of pronunciation and their audio-visual representations in ASR based CAPT systems like soundwaves, spectrograms, and pitch tracking. The participants were then given the freedom to practice such features on their own using the sentence pronunciation activities in MyET. The authors relied on the CAPT software's automatic measures of intonation and stress to assess the development of students' prosodic accuracy. After the eight weeks of practice, and according to the automatic scores generated by MyET, the findings indicated that the participants engaged in CAPT made significant development in their use of stress and intonation.

Khoshsima et al. (2017) looked at the effectiveness of CAPT's self-paced practice in developing the prosodic pronunciation of seven adult Iranian EFL learners (aged between 18 and 26). The participants of this study enrolled in six weeks of suprasegmental pronunciation practice focusing on syllable stress, sentence stress, and intonation using the ASR based CAPT system Clear Pronunciation 2. After an introduction to the use of the software and the prosody features, participants were allowed to use the programs at their own pace at the university and at home with their laptops. To measure participants' pronunciation development, the study relied on the CAPT system's automatic rating of the prosodic features. The findings of the study showed the participants engaged in self-paced CAPT made significant developments in their use of syllable stress, sentence stress, and intonation. According to the authors, the prosodic practice in CAPT was particularly beneficial for participants because they were able to detect their pronunciation problems thanks to the visual features of feedback and work on them wherever and whenever they wanted.

More recently, Yenkimaleki and van Heuven (2019) investigated the contribution of computer-assisted prosody practice in developing the pronunciation of 48 undergraduate students of translation (interpreter trainees) from the University of Tehran, Iran. Participants were assigned randomly into two groups, an experimental group in which 24 participants engaged in prosody practice using the CAPT system "Accent Master" for 12 sessions (60 minutes per-session) for four weeks, and a control group in which participants received 12

sessions (60 minutes per-session) of prosody practice in the traditional classroom. To measure participants' pronunciation development, all of the participants were invited into an interview before and after the training sessions in which their spontaneous speech is recorded and assessed by three expert raters on the basis of syllable stress, sentence stress, accentedness, and overall comprehensibility. The results of the study showed that the groups engaged in ASR based CAPT of prosody made significant pronunciation development in their syllable and sentence stress, accentedness, and overall comprehensibility. In the meantime, the traditional practice group recorded only a slight development in their syllable stress, sentence stress, and overall comprehensibility.

Overall, the empirical evidence found in the CAPT literature demonstrate that practice opportunities offered by the CAPT technology can have a significantly positive effect on EFL learners' prosodic pronunciation development (e.g. Chiu et al., 2007; Khoshsima et al., 2017; Liu & Hung, 2016; Yenkimaleki & van Heuven, 2019). The self-pace nature of CAPT in which the practiced activities can be paused and repeated made from such technology a valuable source for EFL students to work on their prosodic pronunciation problems. Despite such flexible practice opportunities, a common criticism for ASR based CAPT systems is that they take a traditional mechanical drilling approach (Levis, 2007; Neri, Cucchiarini, & Strik, 2002). Advocates of this criticism claim that the pronunciation activities designed in these systems resemble the often criticized pronunciation practice approach "repeat after me" (Yoshida, 2016). This, as found by Tsai (2006), can often lead to a perceived repetitiveness by the training learners. While such suspicion about the pedagogy of CAPT's activities are legitimate, the features such technology offer in return like authentic audio-visual input, self-paced training, and immediate personalized feedback outweigh this deficiency. Moreover, with the continuous evolution of ASR technology, ASR based CAPT systems offer a variety of activities like "listen and choose the correct answer", "free talk", and "listen and complete" that does not only rely on the "listen and repeat" drilling (Yu et al., 2016).

Prosodic practice in CAPT programs is also often criticized for comparing L2 and EFL students' output with models that are usually recorded with native speakers. This criticism is especially important as the user interface of most ASR based CAPT systems visually illustrates the native model and compare it with students' pronunciation output. According to Levis (2007), such reliance on native models often leads to speech recognition failures that can pose a real challenge for EFL learners while practicing. An example of that is the speech recognition failures pointed out by participants in Chiu et al. (2007) and Tanner and Landon (2009). In a pedagogical assessment of pronunciation training in ASR based CAPT systems, Neri, Cucchiarini, Strik, et al. (2002) concluded that native models are not a pedagogically sound

target as they can appear to suggest that L2 students should sound like the models. In a practical sense, however, ASR based CAPT systems rarely explicitly suggest that L2 students should sound like native speakers. Systems like Tell Me More, MyET, and Duolingo often employ native speaker models to serve only as a tool of practice and reference for students (Bajorek, 2017). Moreover, it is the role of the teacher to set pragmatic and achievable pronunciation learning goals that are compatible with the circumstances of EFL students and in line with the latest findings of the L2 pronunciation literature.

2.3.3.3 Immediate personalized feedback

Another important contribution of ASR based CAPT systems to the practice of prosody is the immediate personalized corrective feedback on EFL students' pronunciation (Anderson-Hsieh, 1994; Chun, 1989; Olov Engwall & Bälter, 2007). Unlike traditional pronunciation instruction in the Algerian EFL classroom where students receive little feedback on their use of prosody features due to limited practice opportunities, ASR based CAPT offer Algerian EFL students immediate personalized feedback on their pronunciation output. Feedback in CAPT systems is immediately provided after the students' output, personalized based on the production of the students, and detailed in highlighting the error and correction (Neri, Cucchiarini, Strik, et al., 2002). ASR based CAPT corrective feedback highlights pronunciation errors through the same audio-visual tools used to illustrate the prosody features, namely: audio recording, soundwaves, and pitch contours (picth tracking). Through the speech visualization features, students are able to compare their own pronunciation with that of the model. More importantly, some CAPT programs can also highlight segments or words that were not pronounced appropriately. Such feedback is also accompanied by the audio model where students have the chance to play and replay the correct pronunciation. These corrective feedback features compensate for the broad comments provided by teachers on students' production which might not address the real pronunciation issues of the students. Corrective feedback in CAPT has more potential to raise EFL students' awareness of their pronunciation errors and mistakes and give them a chance to work on them.

To investigate such claims about the corrective feedback in CAPT, an important research trend emerged and focused on investigating the influence of feedback in CAPT systems on L2 students' pronunciation learning. Such an approach originates from a technical background where newly created platforms are presented to students in speech labs and soundproof rooms (e.g. O. Engwall et al., 2006). The empirical procedure within this research trend involves engaging EFL students with newly or already existing ASR based CAPT platforms that utilize different forms of audio-visual feedback in their pronunciation practice

and are only offered guidance about the practice and technology use from the teacher/ researcher when needed. To measure the role of feedback in these studies, students' pronunciation learning results are often compared with the results of control groups where participants are exposed to CAPT without its audio or visual feedback features.

In this regard, DeBot (1983) investigated the influence of individual exposure to CAPT feedback when practicing intonation. In this study, the author aimed at assessing the influence of visual feedback compared to audio feedback that is usually provided in the classroom (e.g. recast). A total of 63 Dutch EFL learners took part in pronunciation training sessions for seven days. Participants were divided into six groups, four serving as experimental groups and two serving as control groups. The first two experimental groups took part in the CAPT training while receiving audio-visual feedback, one with a practice time of 45 minutes per session and another with a practice time of 90 minutes per session. The second two experimental groups took part in the CAPT training while receiving only audio feedback, one with a practice time of 45 minutes per session and another with 90 minutes per session. As for control groups, one with five participants took part only in the pre-test and post-test; meanwhile, the other with ten participants received traditional instruction. In each session, participants were seated in sound-isolating rooms and were provided with 65 sentences rich in intonation patterns. Participants use of intonation was measured through a read-aloud pre-test and post-test that was rated by expert phoneticians (with high inter-rater reliability) on a scale of 1 (very bad) to 5 (perfect). Results of the study showed that participants receiving audio-visual feedback made significantly higher development compared to their counterparts receiving only audio feedback. The practice time in this study did not influence students' development in both groups.

In a non-EFL empirical study addressing the effectiveness of individual exposure to CAPT feedback in phonemic pronunciation practice, Hew and Ohki (2004) compared two types of visual feedback, namely, animated graphic annotations (AGA) with immediate static visual feedback (IVF). 132 Malaysian students of Japanese took part in one session of pronunciation practice that focused on minimal pairs. Participants were divided into three groups: a group using CAPT with text + audio feedback, a group using CAPT with text + audio + AGA, and a group using CAPT with text + audio and static IVF. Results showed that students receiving AGA outperformed their peers receiving static IVF. Such results motivated the integration of talking heads in CAPT systems which provided 3D mouth simulation as feedback (Ali & Segaran, 2013). However, as stated in the conclusion, the practice duration (one hour) allowed only for measuring the short-term effects of the training. Additionally, little qualitative details were presented on how each type of feedback, especially AGA versus IVF, helped students in detecting and correcting their pronunciation mistakes.

The work of Neri, Cucchiarini, et al. (2008), although conducted with Dutch students, is an influential example in examining the effectiveness of individual exposure to CAPT feedback on phonemic and prosodic pronunciation learning. A total of 30 migrants with mixed L1 learning Dutch were equally divided into three groups: an experimental group using CAPT with feedback and two control groups, one using CAPT with no feedback and another receiving no treatments. Trained participants took part in 30 minutes sessions of sentence pronunciation training for four weeks using the CAPT system Nieuwe Buren. To measure students' learning development, participants sat for read-aloud tests of prosodically rich texts before and after the study. The results showed that participants who used CAPT platforms that offered ASR based feedback made the largest mean progress. However, students' developments were only limited to the phonemic level and were not significantly different from the group using CAPT with no feedback.

Another study by Hincks and Edlund (2009) used a similar approach to look at the influence of individual exposure to speech analysis feedback in CAPT on the use of pitch variation among Chinese students of English. The study involved 14 Chinese EFL learners in 4 weeks of individual training with the speech visualizer Snack Sound Toolkit (SST). Students in this study, however, were divided into two groups based on the feedback they were receiving. The experimental group, involved seven students, receiving visual feedback; meanwhile, the control group, involved seven students, receiving only audio feedback. Students' pronunciation development was measured through automatic assessment of pitch variation following the approach applied in (Hincks, 2005). The findings of the study showed that participants in the experimental group made significantly higher developments than their counterparts receiving only audio feedback.

Overall, the corrective feedback offered by ASR based CAPT systems represents a valuable resource for EFL students as it can accurately highlight their prosodic mistakes and correct them This, as found in the reviewed empirical studies (e.g. DeBot, 1983; Hew & Ohki, 2004; Hincks & Edlund, 2009; Neri, Cucchiarini, et al., 2008), helps in raising EFL students' awareness and tracks their progress when working on them. Despite that, a common criticism for this feedback is that it is often difficult to interpret by L2 students (Hansen, 2006; Levis, 2007). While speech researchers can be familiar with the visual representations, students are likely to face difficulties when attempting to interpret them. Such limitation in some CAPT systems violates the comprehensibility criteria of feedback on L2 production (Eskenazi, 1999). This lack of understanding of feedback, as highlighted by Neri, Cucchiarini, Strik, et al. (2002), can make EFL students focus on pronunciation problems that are less influential on their pronunciation intelligibility or comprehensibility and not pay enough attention to more important errors and mistakes. It is, therefore, the responsibility of the teacher to introduce

CAPT feedback elements to their students and explain exactly how they represent each prosody feature.

2.3.3.4 Engaging stress-free environment

Another advantage of ASR based CAPT systems is that they provide L2 students with a free stress environment to practice their pronunciation (Neri, Cucchiarini, Strik, et al., 2002). Unlike in the traditional classroom where L2 students often abstain from taking part in oral activities out of fear of losing face because of judgment from the teacher or their peers (Young, 1990), ASR based CAPT, like in other CALL technologies, provide a more forgiving environment as the oral output of L2 students is usually produced and evaluated in a private environment. Depending on the context in which the CAPT system would be used, the output of students would mainly be heard at the computer (and its surroundings) and most importantly evaluated by the computer through visual representations of the pronunciation features and scores that will only be received by the student. This would help Algerian EFL students, who often feel anxious to take part in oral activities out of fear of judgment from their teachers or their peers (Melouah, 2013), to practice their pronunciation in a stress-free environment.

In an early empirical attempt to investigate those claims about the practice environment of ASR based CAPT systems, Stenson et al. (1992) looked the perceptions of 13 international teaching assistants (ITAs) from the University of Minnesota with mixed L1s towards the practice of prosody features with ASR based CAPT systems. The study utilized the speech visualization program Speech Viewer for eleven sessions, each lasting 50 minutes, and focused on pitch and loudness through sentence pronunciation practice. To investigate ITAs perceptions, the author employed logbooks that were submitted by the end of every session. The results revealed that perceptions about the use of such technology were mostly positive. According to the ITAs reports, the feedback was the most useful feature. Additionally, the participants reported that the use of technology to practice pronunciation boosted their motivation and made their pronunciation practice more fun and innovative. On the other hand, few participants also reported that they did not find the program useful as they faced difficulties in interpreting the visual feedback.

In his doctoral work, T. Lee (2008) investigated the perceptions of 153 college Taiwanese speakers of English towards CAPT versus traditional practice of pronunciation. After using the CAPT system MyET for seven weeks to practice sentence pronunciation, the participants were handed questionnaires containing open ended items that addressed the usefulness of the system used. The findings of the study revealed that the participants preferred CAPT over traditional practice of pronunciation. Such views in the CAPT group were mainly

attributed to the innovation that this program introduced to the practice of pronunciation like feedback and self-paced training. To have a better understanding of the participants' perceptions in this study, the author compared the reports of the participants who used CAPT with those who undergone traditional pronunciation practice. Such comparison revealed that the perceived useful features, like feedback and self-paced training, reported by the CAPT group gave the participants in this group a motivational advantage to learn and practice pronunciation.

In the second part of Hardison's (2004) study investigating the effectiveness of computer-assisted prosody training with 16 native English speakers of French, the author looked at the perceptions of 16 French learners towards practicing prosody with ASR based CAPT technology using semi-structured questionnaires. These questionnaires were completed by the students after they took part in13 sessions of sentence pronunciation training focusing on pitch, stress, and intonation using the ASR based CAPT system Kay Elemetrics Computerized Speech Lab (CSL). The results of the study showed that participants found the innovative audio-visual features of CAPT activities motivating as they offered a new and an interesting approach to learn about and practice French prosody. As a result, participants reported more engagement in pronunciation activities with CAPT than the traditional classroom and increased overall confidence in their French pronunciation and use of prosody features.

The potential of ASR based CAPT systems in reducing students' anxiety and increasing their engagement in oral activities is also worth considering when looking at empirical studies investigating the influence of oral activities in different CALL technologies on students' level of anxiety. Melchor-Couto (2017), for example, looked at the evolution of foreign language anxiety levels of 7 English learners of Spanish when using the virtual world games Second Life for oral activities. The participants used the programs for oral activities for the duration of four weeks. A semi-structured questionnaire with Likert scale and open-ended questions was used to collect data about students' foreign language anxiety which were compared to a group of students (seven English learners of Spanish) who took part in the same activities in a traditional classroom environment. The results showed that participants using the virtual world game for oral activities reported significantly lower anxiety levels than their counterparts in the traditional classroom. The results also showed that the levels of anxiety of participants using the virtual world games were decreasing faster than their counterparts in the traditional classroom environment.

In summary, the results of empirical studies on CAPT highlight the importance of its stress-free environments in increasing L2 students' willingness to take part in pronunciation activities and their positive influence on students' learning. Unlike oral activities in the

traditional classroom where EFL students are often held back by their fear of negative judgment (e.g. Melouah, 2013), participants in CAPT studies often report less anxiety (e.g. Melchor-Couto, 2017), and more engagement in prosody activities (e.g. Hardison, 2004; Stenson et al., 1992) thanks to the technology's private and innovative practice environment. Such reported benefits of CAPT, however, do not guarantee an improvement in students' pronunciation engagement in real-life spontaneous interactions. While CAPT of prosody may offer students a chance to work on their pronunciation problems in a stress-free environment, students will still have to take part in real-life interactions during their course or after graduation. More research is, therefore, needed on the influence of CAPT activities that simulate real-life interactions on students' levels of anxiety and engagement.

2.3.4 A critical reflection on the available literature investigating CAPT of prosody

Overall, the available literature highlights the positive contribution of the ASR based CAPT systems in the practice of prosody features. The technology is proven to have the potential of providing EFL learners with explicit instruction on the different English prosody features with authentic input, self-paced practice opportunities, and immediate personalized feedback in an engaging stress-free environment. Self-paced training, as reported in Chiu et al. (2007) and Hardison (2004), and personalized feedback, as reported in Stenson et al. (1992) and Neri, Cucchiarini, et al. (2008), make from CAPT a particularly beneficial and engaging environment to practice suprasegmental features. Despite such highlighted advantages, studies on CAPT employ almost exclusively an individual approach to the practice of prosody with the technology in highly controlled classrooms or speech laboratories. While it is true that these technologies are designed for self-paced and personalized pronunciation feedback, such an approach to the study of CAPT risk overlooking the challenges that can be faced by students when practicing with the technology on their own. Attention to such challenges is particularly important considering the findings of studies on CAPT with an individual approach which showed that students engaged in individual CAPT often faced difficulties in understanding the technology's illustration of prosody features, found the practice repetitive, and sometimes misinterpreted the corrective feedback provided by the technology. Anderson-Hsieh (1992), for example, emphasized the importance of introducing the visual representations of prosodic features before engaging students in individual CAPT as such features can be overwhelming for those who are inexperienced with the technology. As far as practice is concerned, EFL students in Chiu et al. (2007) and Tsai (2006) reported finding individual CAPT repetitive and mechanical as the sessions progressed. Moreover, in O. Engwall et al. (2006) and Stenson et al. (1992) and Tanner and Landon (2009), EFL students engaged in individual CAPT reported that it was often difficult to interpret feedback on a prosodic level. In addition to such pedagogical

challenges, it is also worth remembering that many newly developed CAPT systems can face a variety of technical limitations when dealing with suprasegmental pronunciation, especially those relating to speech recognition like trying to predict the appropriate intonation, or stress placement (Levis, 2007; Neri, Cucchiarini, & Strik, 2002). Such issues in individual CAPT, when kept unaddressed, can severely hamper the learning and practice experience of EFL students and addressing them is especially important when considering the results generated by Hsu (2016) showing the positive correlation between perceived ease of use and perceived usefulness of CAPT. The next section, therefore, presents a framework for collaboration in ASR based CAPT as an alternative approach to the practice of prosody in CAPT to address such limitations in individual practice.

2.4 A Theoretical Framework for Collaboration in CAPT of Prosody

The current study adopts a sociocultural perspective to explore the effectiveness of collaboration in CAPT to practice prosody features as an alternative to the predominant individual CAPT approach. This last section of the second chapter, therefore, introduces collaboration as a practice that is inspired by the sociocultural theory and the rationale behind employing it to research CAPT. The section is divided into four main parts. The first part starts by introducing the sociocultural approach to learning and defining its key concepts. The second part considers collaboration in the language learning context, its structure, and its advantages compared to the teacher-centered approach. The third part then discusses the potential advantages of collaborative CAPT of prosody based on evidence from collaborative studies with different CALL technologies. Finally, this section reviews the available literature on collaborative CAPT, highlights the gap within the literature, and presents the aim and research questions of the current study.

2.4.1 The sociocultural approach to learning: introducing key concepts

Vygotsky's sociocultural theory (SCT) argues that learning is primarily a social activity (Vygotsky, 1980). According to this theory, all human knowledge is co-constructed in society and mediated to the individual through cultural artifacts like language and numbers. This theory, therefore, regards social interaction as a fundamental process for the learning and development of the individual. Such learning, as highlighted by Lantolf (2000, p. 197), happens when individuals take part in cultural, linguistic, and historically constructed settings like family, schools, and work places. In this approach, learning development is measured by the extent to which an individual can manifest a knowledge that was mediated and internalized in society independently from the support of others. This section introduces four main concepts that

explain the learning process from a sociocultural perspective, namely, mediation, imitation, internalization, and the zone of proximal development (ZPD).

2.4.1.1 Mediation

Mediation, according to the SCT, is the process through which knowledge is transferred from a social level to an individual level. This transfer of knowledge employs high level cultural tools like literacy, language, numbers, and symbols. Similar to the tools used by humans to affect the physical world, Vygotsky argues that humans also use cultural tools to control, organize, and develop mental processes (Lantolf, 1994). Just as the hammer serves as a mediation tool for humans to put a nail into a wall, language and symbols mediate between the individual and the knowledge co-constructed within the society. According to Vygotsky, mediation takes two main forms, namely: mediation through regulation, and symbolic mediation (Vygotsky, 1980). Mediation through regulation is a three stages process that starts with object regulation and gradually moves to other-regulation to finally reach the advanced level of self-regulation. *Object regulation*, as defined in Lantolf (2000), is a type of mediation that mostly takes place with children through the use of objects to help them think about the social-material world. An example of object regulation is the use of blocks to help children perform simple arithmetic operations. Such form of mediation is often used with children as they do not yet possess abstract thinking abilities. *The other regulation* is a form of mediation through which guidance is provided to the individual by parents, siblings, friends, and teachers. An example of the other regulation in the second language classroom would be the feedback provided by the teacher on the learner's use of language. This form of mediation is especially important in the sociocultural theory as the individual is considered to be part of the society and not independent from it. As for *self-regulation*, Lantolf (2000) defines it as the last stage of mediation through regulation whereby the individual is capable of accomplishing activities with minimal support from other members of the society. This level of regulation is achieved when the individual controls an activity and is capable of noticing his/ her mistakes and correcting them without the need for external assistance. At this stage, a learner will no longer require blocks to complete arithmetic operations or teacher's feedback to correct his/ her use the language. On the other hand, symbolic mediation, according to Vygotsky (1980), refers to the cultural symbolic tools created and used by humans to mediate their mental processes. While the concept of symbolic tools is often used to refer to language as a uniquely human artifact, it also includes numbers, graphs, art, and music as other human artifacts that can greatly contribute to mediation of knowledge in the SCT. According to Lantolf (2000), symbolic tools allow humans, unlike other species, to control their internal psychological processes and mediate them to the social material world. The architect, for example, designs building plans to mediate the construction of real buildings

without acting on them in the physical world. This unique property allows humans to anticipate scenarios in the world, plan possible courses of action, and communicate them with society at large.

2.4.1.2 Imitation

According to Vygotsky's sociocultural approach, human learning relies heavily on the unique human ability of imitation. In language learning, such process is a conscious and self-selective process through which humans acquire knowledge from society (Lantolf, 2000, p. 203). This process cannot be triggered by the repetition of input models presented by the teacher as proposed in the Audiolingual method (Richards & Rodgers, 2014, p. 44). According to Meltzoff (2002, p. 19), successful imitation usually takes place after the learner was spontaneously exposed to a linguistic pattern in a particular social environment. This is mainly because it relies on a set of arbitrary factors which are not always aligned with the curriculum goals and classroom practices. These factors include, and are not limited to, students' motivation, interests, and communicative requirements. However, while it can be challenging for the teacher to predict the factors of successful imitation, it is possible to simulate the social interaction that facilitates its occurrence in the classroom (Lantolf & Yanez, 2003). In the language classroom, this can be achieved through language learning activities that allow interaction between students. Saville-Troike (1988), for example, observed instances of immediate and delayed imitation when students engaged in educational roleplays. In another study, Lantolf and Genung (2002) reported evidence for delayed imitation by L2 students through interviews and diary activities.

2.4.1.3 Internalization and appropriation

Internalization, in the SCT, refers to the acquisition of knowledge co-constructed in society by the individual. According to Vygotsky (1980), "every psychological function appears twice, first between people on the interpsychological plane and then within the individual on the intraspychological plane" (p. 57). Through the process of internalization, social cultural artifacts, like language, shift from a social level to an individual level. Successful internalization in language learning, for example, takes place when the learner is able to selectively imitate a linguistic pattern within its suitable context after having been introduced to it by society. The concept of internalization in the SCT, however, has been slowly replaced with the term appropriation. This concept, according to Smagorinsky (2012), "refers to the process through which a person takes up and makes use of the tools available for use in a particular social environment and through this process develops ways of thinking endemic to specific cultural practices" (p. 33). In other words, the emphasis is on the appropriate use of language in a

specific context. The increased use of this term comes as a result of the evolution of the concepts of internalization and mind in the literature studying and adopting the SCT. While early adopters of the SCT saw the mind as a separate property within the individual's brain, recent sociocultural theorists argue that the mind is a distributed entity within the society. Wertsch (1993), as an advocate of the SCT, asserts that the mind extends beyond the human body and it is strongly linked to its social context through the cultural artifacts used for mediation. Accordingly, a language learner who produces a creative piece of writing, for example, is appropriating a cultural tool (i.e. language) to create a product relevant to the society.

2.4.1.4 The zone of proximal development

The ZPD, according to Vygotsky (1980), refers to "the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1980, p. 86). In other words, the ZPD refers to the set of activities which the learner can accomplish with external support. Such space offers the optimal learning opportunity when learners are provided with teacher guidance or are engaged in collaborative practices with more knowledgeable and capable peers. The SCT argues that what the learner can achieve with guidance in the present is a good indication to what they will be capable of doing on their own in the future. This stems from the fundamental argument in the SCT that all learning is achieved with members of society. The measurement of learning in the SCT relies on the extent to which students require support (Lantolf, 2000, p. 208).

2.4.2 Collaboration and the sociocultural approach to language learning

As is the case with learning in general, the SCT regards language learning as a social activity that relies primarily on interaction (Lantolf, 2000). Consequently, proponents of this perspective to language learning recommend activities that simulate social settings. In other words, the SCT attempts to involve students in activities where they are active participants working with their peers while also receiving guidance from both their peers and from their teacher. This approach to language learning comes as a counter movement to the teacher-centered and cognitive approaches which assign the student a passive recipient role and gives most control to the teacher. A widely used form of activities in language learning settings that were inspired by the SCT is collaborative learning (Dillenbourg, 1999). The term *collaborative learning* (CL) is generally used when referring to a learning activity that involves two or more students working together to complete a task. However, this definition of collaborative learning is often confused with cooperative learning. While both terms can be used interchangeably, as noted in Paulus

(2005), they can refer to vastly different forms of learning. In this study, the term collaborative learning refers to, as defined by Roschelle and Teasley (1995), "a coordinated synchronous activity that is the result of a continued attempt to construct and maintain a shared concept of a problem" (p. 70). According to this definition, having two or more students present in the same setting to do the same activity does not guarantee for collaboration to take place. In collaborative learning practices, the labor is shared among students and the completion of the activity relies on the coordination of students. This definition of collaborative activities differs categorically from that of cooperative activities in which, as stated by Henri and Rigault (1996), the tasks are divided among students, completed individually, and students do not share a responsibility for their peers' production.

In order for proper collaboration to take place, Kagan (1992) details four main essential components, 1) simultaneous interaction, 2) positive interdependence, 3) individual accountability, and 4) equal participation. Unlike the teacher-centered approach where the students' talking time is largely minimized and controlled by the teacher, collaborative learning offers multiple students the opportunity to participate at the same time. The second essential component of collaboration is the positive interdependence between students. This component takes place when students intervene to assist each other for learning or the completion of a task. Unlike cooperative learning where students are engaged in their task individually, collaborative learning allows students to depend on each other to achieve their common goal. The collaborative learning environment is also characterized by a sense of responsibility, also referred to as individual accountability, of students about their own and peers' learning. This motivates students to help their peers and give them feedback. Finally, equal participation is a crucial component of collaborative learning. Unlike cooperative learning where students can end up with unequal amounts of labor depending on their task, collaborative learning offer an environment that ensures students' equal contribution.

The support for collaborative learning within second language acquisition (SLA) research originates from Long's (1996) interactional hypothesis. Long (1996) built on both Krashen's (1985) input hypothesis and Swain's (1985, 1995) output hypothesis but also highlighted the important role of social interaction in language learning. In his early input hypothesis, Krashen (1985) emphasized the importance of comprehensible input in language acquisition. According to this theory, it is necessary for L2 learners to be exposed to an input that is slightly higher than their current language level for learning development to occur. Under this premise, the language teacher is expected to provide reading texts of upper-intermediate level for L2 students of lower-intermediate level so that learning can take place. Swain (2000), on the other hand, argues that second language development require opportunities for practice

and language production. According to this theory, students' output gives them a clear idea about their language performance and mistakes and allow them to develop. Long (1996), however, acknowledges the two theories and argues that face to face interaction promotes opportunities for both language production and compressible input. According to Long's (1996) perspective, when L2 students interact using the target language, they engage in what is known as negotiation of meaning. This latter, as defined by Pica (1994), is "an activity that occurs when a listener signals to the speaker that the message is not clear and the speaker and the listener work linguistically to resolve this impasse". In a second language learning context, this is a process through which the speaker and their peer attempt to overcome language use problems through repetition, clarification, and modification of output.

The collaborative movement within SLA research takes an opposite direction to that of the cognitive individual movement in SLA which largely focuses on the individual experience of learning the language. Collaborative learning advocators in SLA argue that language learning is best achieved in an interactive classroom settings (Lin, 2015). Such settings would offer L2 learners a constructive learning environment where students share knowledge and help one another, as opposed to the individualistic competitive approach. Moreover, and unlike the teacher-centered approach where the teacher is the only knowledge transmitter and main source support and controller, collaborative classroom provides a more active role for students. The following table, adopted from Lin (2015), provides a comprehensive comparison between individual and collaborative language learning.

Table 2.2 Characteristics of collaborative and individual language learning

Characteristics	**Collaborative learning**	**Individual learning**
Classroom physical set-up	U-shaped or CL groups	Rows of separate desks
Type of activities	Interactive activities	Drills, knowledge review, and recalls
Role of the students	Active participant and autonomous learner	Passive recipient
Role of the teacher	Facilitator	Knowledge transmitter and main source of support
Teacher-student relationship	Complimentary and equal	Superior teacher and inferior student
Type of interaction	Equal teacher-student and student-student interaction	Mostly teacher-student interaction
Independence of the student	Positive	Negative

Adapted from (Lin, 2015)

2.4.3 The rationale for collaboration at the computer in CAPT of prosody

The current study proposes collaboration at the computer with the ASR based CAPT systems as an alternative to address the limitations found within the literature investigating individual practice of prosody with the technology. The continuous evolution of the CALL industry allowed for the emergence of language learning programs containing features that facilitate collaboration and interactivity between students. Collaborative practices in CALL take two main forms: collaboration through computer mediated communication (CMC) tools and collaboration at the computer. According to Warschauer (1997), much of the interest in collaboration within CALL stems from the emergence of CMC technologies that allow for communication between students using two or more electronic devices. Such technologies allow language students to collaborate despite time and location limitations, thus, maximizing the chances for compressible input and opportunities for production in the target language. For this reason, many CALL researchers see the potentials of this technology to connect their language speaking classrooms to the world (e.g. Tsukamoto, Nuspliger, & Senzaki, 2009) and develop students' communicative competence (e.g. Chen, 2005). Moreover, with the increase of file-sharing platforms like Dropbox and Google Docs, the focus on CMC collaboration also include reading and writing activities (e.g. Zhou et al., 2012). Collaboration at the computer, on the other hand, involves two or more students working together simultaneously in the same setting and time while using a single computer device for a language learning activity (Beatty, 2013, p. 121). In such practices, the teacher tries to promote collaboration using different technologies and electronic devices. Examples can include, but are not limited to, language learning programs, digital games, interactive screens, and other multimedia tools. This type of CALL collaboration guarantees face-to-face interaction, emphasized by Long (1996), in addition to the advanced features of technology. CALL collaboration is especially ideal for students or schools which have limited access to computers as it minimizes the amount of technological resources needed for activities.

Collaboration at the computer with ASR based CAPT systems has the potential to facilitate the technical, linguistic, and psychological challenges faced by students in the individual access mode. The likelihood of such positive potential is especially worth considering when looking at the increasing CALL literature investigating the effectiveness of collaboration at the computer (Jeon-Ellis et al., 2005; L. Jones, 2006; Warschauer, 1996). Such a trend of CALL research has been particularly motivated mainly by the emerging evidence in favor of collaborative language learning (Beatty, 2013). Empirical studies on collaborative CALL mostly take a randomized control trial form where a number of participants (students) are engaged in collaborative activities with a CALL device. The effectiveness of collaboration is

measured through pre-tests and pot-tests and compared with the results of participants who engaged in similar activities but through an individual access mode. Overall, the results in this area mainly highlighted the potential benefits of collaborative CALL on a technical, linguistic, and motivational levels.

On a technical level, the collaborative CALL research shows that collaboration at the computer has the potential to eliminate the technical hurdles faced by students when engaged with the technology individually. The study of Jeon-Ellis et al. (2005), for example, provided evidence showing that collaborative CALL practices at the computer put students in a situation where they take the initiative to help their peers to overcome technical problems. The authors in this study engaged eight English speakers of French in collaborative oral activities at the computer for a complete semester. To track participants' interactions, the study employed audio-video recordings, computer screen capture, questionnaires, and interviews. The results of the study showed that when students were faced with technical problems at the computer, they primarily relied on their peers, whether novice or expert with technology, to overcome them. This is mainly because the social and interactive nature of collaborative CALL makes the use of technology slightly more public which helps in revealing the challenges faced by the students while providing friendly opportunities for their peers to intervene and assist them.

With ASR based CAPT systems, such mode of access is especially needed when considering the technology's limitations in addressing prosody features and the research-based evidence for their negative influence on students' practice experience. In particular, collaboration at the computer has the potential to help students in overcoming the technical challenges affecting the navigation of the system's user interface (UI) and the software and hardware issues affecting the display of audio-visual input and speech recognition. This is mainly because the collaborative environment allows students to benefit from their peers' experience with CALL technologies and knowledge about CAPT platforms. The user-interface issues highlighted by Anderson-Hsieh (1994), for example, can be tackled through mediation with more CALL/ CAPT experienced peers. Similarly, collaborative CAPT also has the potential to help students overcome and deal with the hardware or software issues which, as highlighted by Levis (2007) and found by Chiu et al. (2007) and Tanner and Landon (2009), can negatively affect the display of input, speech recognition, and consequently the practice of prosody. This can significantly improve students' practice experience as collaboration would allow them to spend more time making the most of CAPT's features instead of having to deal with its technical difficulties alone.

In terms of language learning and practice, collaboration at the computer with CALL systems allow for genuine social interaction and thus maximizing the chances for negotiation of meaning between students (Beatty, 2013, p. 122; Kowal & Swain, 1994). Unlike individual exposure to technology where students' language production is completely private, collaborative CALL practice makes students' language production public to their peers providing more opportunities to produce, receive feedback, and modify their output. In an attempt to provide evidence for the negotiation of meaning in collaborative CALL, L. Jones (2006), compared the effectiveness of collaborative and individual exposure to Multimedia. The study enrolled 68 adult students of French from the University of Arkansas in vocabulary learning and listening comprehension activities with different multimedia tools throughout the Fall semester. During the training, the participants were randomly assigned into four groups: individual and collaborative listening with and without pictorial and written annotations. The results of this study showed that the participants with collaborative exposure to multimedia made significantly more vocabulary and listening comprehension learning progress than their peers with individual exposure. According to the author, the results of this study are in line with Vygotsky's (1980) principle of progress through ZPD. This is mainly because students' learning was reinforced by their ability to discuss and clarify input with their peers while at the computer.

With ASR based CAPT systems, such a negotiation of meaning would offer EFL students an ideal interactive environment to work on prosodic pronunciation perception and production problems. In terms of perception, students can become more comfortable having their peers with them to help them understand the native speech models and their visual representations provided by the CAPT program. Through collaboration and instances of negotiation of meaning, participants in CAPT can overcome the challenges of understanding the audio speech models faced by EFL students in individual CAPT (e.g. Tsai, 2006). Collaboration in CAPT is also important considering Levis's (2007) emphasis on the complexity of some visual illustrations of prosody like spectrograms and the evidence found about the difficulty of their interpretation in individual CAPT (e.g. O. Engwall et al., 2006; Stenson et al., 1992; Tanner & Landon, 2009). As for production, a collaborative CAPT setting for prosody practice would allow for opportunities to speak more than in a teacher-centered classroom or in individual CAPT because students would engage in CAPT while interacting with their peers and hence increasing chances for instances of negotiation of meaning. Such instances are particularly needed when considering the speech recognition failures in ASR based CAPT systems (e.g. Levis, 2007), and what follows them from the (sometimes) unrealistic and too difficult to meet feedback (e.g. Tsai, 2006). Instead, students would compensate for such

challenges by working on their prosodic pronunciation issues through repetition and modification of output with their peers. This is very likely especially with supporting evidence found by Bitchener (2004) showing that collaborative (interactive) pronunciation activities allow for successful instances of negotiation of meaning that result in long term pronunciation learning.

Collaboration at the computer also has the potential to increase students' motivation and engagement. Unlike individual exposure to CALL platforms which can be isolating and tedious, collaborative CALL practices at the computer promote social interactivity, which in turn increases learners' interest and engagement in the activities. This is especially likely with the available evidence on the positive correlation between collaborative use of CALL technologies and the motivational levels of students. The survey results with 167 EFL students by Warschauer (1996), for example, showed that the collaborative use of CALL for writing and communication activities significantly increased students' levels of motivation. The factor analysis conducted in this study revealed three main factors contributing to the increase in students' motivation levels, namely, communication, empowerment, and learning. The students engaged in collaborative CALL found the environment motivating because it made them feel as part of a community by facilitating their communication and empowered them by giving them the learning tools and control over the pace of that learning.

In CAPT of prosody, collaboration at the computer would offer students the chance to practice their pronunciation in an environment that promotes genuine social interaction. Such interactivity, unlike the solitary and repetitive prosody practice found in individual CAPT (e.g. Chiu et al., 2007; Tsai, 2006), would result in greater enthusiasm and engagement from students. AbuSeileek (2007), for example, provided empirical evidence showing the positive influence of collaborative oral practices with CALL technologies on the engagement of timid students. The study enrolled 130 adult EFL Saudi students in 16 weeks of training sessions focusing on oral skills (namely: fluency and pronunciation). To assess the value of collaboration, participants were randomly assigned into collaborative and individual groups in CALL and traditional environments. The questionnaire results of the study showed that collaboration promoted more engagement. The smaller groups of collaboration encouraged students to interact casually and provided a more tolerate environment to their mistakes. This, unlike the fear of teacher and peers' judgment which is often found to negatively affect students' willingness to participate in the traditional classroom (e.g. Osterman, 2014), would relieve students from the anxiety of taking part in oral activities.

Overall, the research literature investigating the effectiveness of collaboration at the computer show the positive role of such access mode to CALL technologies in eliminating the technical, linguistic, and motivational challenges faced by students individually (Jeon-Ellis et al., 2005; L. Jones, 2006; Warschauer, 1996). However, and while it is the first step towards collaborative CALL practices, the success of collaboration cannot only be guaranteed by the physical set up of two or more students engaging in activities with a single electronic device. In their essence, collaborative CALL activities require a meaningful purpose for collaboration and an explicit explanation of how students should collaborate (Beatty, 2013, p. 116; Kessler & Bikowski, 2010). These guidelines need to be introduced to the students before embarking on the collaborative task. Otherwise, the collaborative activity loses its purpose as students would lack the willingness to collaborate and resort into individualistic practices instead of sharing the effort to complete the task.

2.4.4 The Available research literature on collaborative CAPT

The recent years witnessed a slight increase in studies exploring collaborative CAPT (Elimat & AbuSeileek, 2014; Luo, 2016; Tsai, 2015, 2019). This trend of research was motivated by the increasing evidence for the effectiveness of collaborative language learning and collaborative CALL practices inspired by the sociocultural cultural approach (Beatty, 2013, p. 108). Such theoretical approach allows for the investigation of CAPT from a fresh perspective considering the influential role of collaboration between EFL students and the outcomes it can yield on their pronunciation development, need for technical guidance, and their perceptions towards the technology. The common empirical procedure in this trend of research involves engaging two or more groups of participants with CAPT through pair or group exposure to the technology. During the practice, participants are asked to work together to finish the CAPT activities. As is the case with individual CAPT studies, pronunciation development in this type of research is also measured according to the learning goal planned by the researcher (i.e. accentedness, intelligibility, or comprehensibility) and compared to the results of participants who were engaged in CAPT individually. These studies also employ different tools to observe collaboration and track the perceptions of students towards such access mode with CAPT technologies, namely: questionnaires, interviews, and learning logs. This section summarizes and critically reviews the available studies on collaborative CAPT while highlighting its technical, linguistic, and motivational advantages and challenges.

The first study to review is that of Elimat and AbuSeileek (2014) which compared three types of access to CAPT, namely: self-access, peer-access, and group access. To do this, the authors enrolled 64 adult EFL learners from a university in Jordan eight weeks (twice a weeks)

of pronunciation training that addressed both the phonemic and prosodic features using the program Tell Me More. The participants were randomly assigned into four groups: an individual CAPT group, a pair group, a group work CAPT group, and a control group that received traditional pronunciation practice. To measure the learning development, participants took part in controlled dialogs that were recorded and rated by Jordanian English language teachers on a three points scale of communicative competence (1 = has no communicative competence, 3 = has full communicative competence). The findings of the study revealed a significant development of the experimental groups using CAPT compared to the control group that followed the traditional training. As for the effectiveness of the different access modes, the results of the study showed that the participants using CAPT individually demonstrated better (but not significant) pronunciation developments compared to their peer practicing in pairs and groups. Such results, as justified by the author, were due to the personalized training nature of ASR based CAPT platforms which favors individual practice.

In another study investigating the effectiveness of collaborative CAPT, Tsai (2015) enrolled 90 adult EFL learners from Taiwan in 10 weeks of sentence pronunciation practice with prosodically rich texts using the CAPT system MyET. The participants were equally divided and randomly assigned into three groups of 30 including two experimental groups and one control group. In the first experimental group, participants were exposed to the CAPT system individually, while in the second experimental group the same system was used in pairs. Meanwhile, the participants of the control group used Mp3 recordings for pronunciation practice. To assess the pronunciation learning development, the participants took part in controlled reading activities before and after the intervention in which their speech was recorded and then rated by four expert listeners on the basis of overall pronunciation, intonation, and timing. To reflect on their CAPT experience and their perceptions toward the technology, all of the participants were asked to complete learning logs by the end of every session. Overall, the pronunciation test results showed no significant learning differences between the three groups of the study. According to the author, this lack of differences between the groups is likely to be a result of the long duration of the training sessions which may have given the participants in the three groups enough practice time to improve their pronunciation. The qualitative results of the learning logs, on the other hand, revealed that the participants accessing CAPT collaboratively reported facing the least difficulties and more learning gains than their counterparts who were engaged in CAPT individually. According to the participants of the collaborative group, the assistance from their peers facilitated their understanding of the audio-visual input and interpretation of feedback. Meanwhile, the participants of the self-access group reported facing more difficulties in interpreting the audio-visual feedback and perceived the

practice to be lonely and repetitive. Despite such reported benefits of collaboration, the participants of the collaborative group felt that the interaction with their peers cost them a lot of valuable time that could have been otherwise invested in the practice. Moreover, the participants in this group reported that they still trusted teacher feedback and guidance on their pronunciation more than their peers despite the latter having benefits in interpreting automatic visual feedback. Similar remarks were also raised by the participants in the self-access group who relied on the teachers' guidance for understanding the automatic visual feedback of the program.

In a more recent replication study, Tsai (2019) investigated collaborative and individual pronunciation practice in CAPT with 60 Thai EFL students. The study engaged students in a 10 weeks course focusing on segmental and supra-segmental pronunciation practice using the CAPT system MyET. For data collection, this study employed learning logs and semi-structured questionnaires to get insights into students' perceptions about the training software and to help students reflect on their pronunciation progress before, during, and after the study. Similar to the results found in Tsai (2015), the results of this study showed that participants practicing collaboratively reported more gains and less difficulties than their counterparts in the individual CAPT group. In this regard, participants engaged in collaborative CAPT reported an increased awareness of their pronunciation errors. According to the author, the results highlighted the complementary relationship between the technological innovation of CAPT technology and human mediation. While the first provide unlimited pronunciation input, opportunities for self-paced practice, and immediate feedback, the latter provide interaction that maximizes the benefit from such features.

Following a slightly different approach, Luo (2016) looked at EFL students' perceptions toward collaborative feedback in CAPT. In this study, 55 Chinese EFL students took part in 12 weeks of self-regulated training using the online sound recording and editing website GoldWave that involved listening to native speech models, recording output, and reviewing peers' pronunciation. The participants were randomly assigned to an experimental group exposed to CAPT and a control group exposed to traditional classroom pronunciation practice. The training sessions in the experimental group involved two main stages, practicing and reviewing. During the practice stage, EFL students were introduced to pre-recorded native speech models where they listened to them, repeated them, and once they were satisfied with their pronunciation output, they recorded it and uploaded it to the online service. During the reviewing stage, participants were randomly presented with the recordings of their peers to review and provide feedback on the overall pronunciation quality. To measure their pronunciation learning development, the participants took part in recorded read-aloud activities

before and after the intervention. The pronunciation output of participants was then rated by expert listeners on a three-point scale of general pronunciation quality (0 = native to near native-like pronunciation, 3 = sever errors that influence intelligibility). The participants were also expected to complete structured questionnaires addressing their perceived progress, perceived use of the technology, and perceived usefulness of peer feedback. The test results of the study showed that participants in the experimental group made significant pronunciation learning development on both segmental and suprasegmental levels compared to the traditional training group. Such outcomes showed the added value of peer review on pronunciation which is often absent in the classroom with a large number of students. As for the questionnaire results, the participants' perceptions toward the use and usefulness of the technology were positive. In terms of feedback, and while the majority of participants reported that listening to their peers' pronunciation was beneficial, only few participants reported that their peers' feedback was beneficial to them. This, according to the author, echoed the proposition of Rieber (2006) implying that peer review can help reassure students about the direction and aims of the activity. In the case of this study, peer review of recordings helped students recognize their pronunciation problems by listening to their peers' output. With regards to the usefulness of peer feedback itself, although most of the participants reported that their feedback would be useful for their peers, fewer participants found the feedback useful. According to the author, the latter findings resonate with the propositions presented in G. Lord (2008) and Srichanyachon (2011) implying that students value their teacher's feedback or a native speaker's feedback due to their experience with the target language more than their peers.

2.5 A Critical Reflection on the Available Collaborative CAPT Literature

Despite having an innovative and promising perspective on the use of the technology, the studies investigating collaborative CAPT are significantly fewer than those looking at individual CAPT. Since the emergence of ASR based CAPT systems by the late 90s, most of the studies on the use of this technology in pronunciation practice took an individualistic approach whereby L2 students are exposed to a newly developed or an already exciting system and tested on their pronunciation learning (e.g. Chiu et al., 2007; Hardison, 2004; Neri, Cucchiarini, et al., 2008; Seferoğlu, 2005; Stenson et al., 1992; Tanner & Landon, 2009; Yenkimaleki & van Heuven, 2019). Meanwhile, the interest in researching collaborative CAPT has only recently emerged with studies addressing the effectiveness of collaboration in CAPT through pair or group access to the technology (e.g. Elimat & AbuSeileek, 2014; Tsai, 2015). This comes in spite of an important evidence based research trend highlighting the potential benefits of collaboration in language learning and CALL technologies (Beatty, 2013, p. 122). Consequently, the area of

collaborative CAPT is still under-researched as it contains theoretical, methodological, and contextual gaps that hinder the understanding of such access mode to this technology.

On a methodological level, most of the available literature on collaborative CAPT took a predominantly quantitative approach whereby the primary focus is on measuring the overall pronunciation learning development more than shedding enough light on the role of collaboration in such learning development. Overall, most of the reviewed studies on collaborative CAPT engaged EFL students in general pronunciation practice that did not explicitly address or assess prosody features. With the exception of Tsai's (2015) study which explicitly addressed the practice of intonation, most of the studies involved general pronunciation practice targeting both phonemic and prosodic features (e.g. Elimat & AbuSeileek, 2014; Luo, 2016). This lack of focus on prosody features comes despite evidence for their role in attaining the more pragmatic and achievable pronunciation learning goals such as intelligibility and comprehensibility (Munro & Derwing, 1995; Saito et al., 2016). Such pronunciation learning goals were also not addressed through the pronunciation learning measurement tools employed in most of the reviewed studies about collaborative CAPT. Instead, most of the studies employed measurement scales that may not particularly align with the L2 pronunciation assessment literature. For example, Elimat and AbuSeileek (2014) employed a communicative competence scalar rating which can be interpreted by raters to address fluency and grammatical accuracy along with pronunciation. On the other hand, Tsai (2015) employed a general scale of pronunciation goodness, while Luo (2016) employed a scale that included two contradicting pronunciation criteria on the same scale (i.e. accentedness and intelligibility). Such broad assessment tools can be interpreted differently by the raters depending on their understanding and beliefs about pronunciation. This can explain the lack of reporting significant pronunciation learning development in the reviewed studies about collaborative CAPT.

To highlight the value of collaboration, most of the reviewed collaborative CAPT studies employed data collection tools that elicit information from the study like learning logs, questionnaires, and interviews. For example, Tsai (2015, 2019), employed learning logs and semi-structured questionnaires that revealed a higher frequency of gains and only fewer difficulties in collaborative CAPT compared to individual CAPT. Similarly, Luo (2016) employed structured questionnaires that showed the positive influence of peer feedback in collaborative CAPT. Meanwhile, the study of Elimat and AbuSeileek (2014) employed a purely quantitative approach that looked only at pronunciation learning development. However, while such data collection tools are effective in generating information about students' perceptions toward collaborative CAPT, they may not provide an objective reflection on the contributing

factors of collaboration to students' pronunciation learning and their perceptions towards CAPT. For example, while Tsai (2015, 2019) found more learning gains in the collaborative group and the results of Luo (2016) revealed high mean positive perceptions toward peer feedback, the results gave very little insights into how collaboration exactly helped the participants with the CAPT systems. On the one hand, this is due to the lack of systematic data collection tools that evaluate students' perceived ease of use and usefulness of CAPT in a collaborative access mode like the TAM model employed by Hsu (2016). On the other hand, this lack of depth in the qualitative data is also due to the lack of direct observation which would provide a more objective and detailed account on the process, advantages, and challenges of collaborative CAPT (Miles, Huberman, & Saldana, 2014, p. 14).

As far as the context is concerned, the reviewed studies took place in contexts that are significantly different from the Algerian linguistic and educational situation. The studies of Tsai (2015, 2019) and Luo (2016), for example, were conducted with adult Taiwanese and Chinese EFL learners respectively. Irrespective of the completely different linguistic situation, the educational systems in these contexts differ completely from that of Algeria. Both EFL teachers and students in China and Taiwan receive more training and exposure to new CALL technologies than Algeria EFL teachers and students do (Nadia, 2011; Tawil, 2006). Moreover, while Elimat and AbuSeileek (2014) investigated collaborative CAPT with Jordanian Arabic speakers, a more similar context to Algeria, their study did not specifically focus on prosody features and therefore provided little insights to address the limitations facing the teaching and practice of prosody in the Algerian EFL context. Moreover, the study was conducted with participants who spoke Jordanian Arabic which is significantly different from Algerian Arabic. Such Arabic dialect differences can influence EFL learners' pronunciation and their use of prosody features differently due to L1 transfer. Therefore, pronunciation instruction and practice with EFL learners in the two contexts can require a focus on different phonemic and prosodic aspects of English pronunciation.

2.6 Research Aim and Questions

Given to the theoretical, methodological, and contextual gaps of the reviewed literature on CAPT, the current study aims to explore the collaborative CAPT of prosody features (namely, syllable stress, sentence stress, and intonation) with Algerian EFL students. To address this aim, three main questions and six sub-questions (two for each question) were asked:

1. To what extent does collaborative CAPT of prosody features enhance Algerian EFL learners' pronunciation learning?

1.1. To what extent does collaborative CAPT of prosody features enhance Algerian EFL learners' **use of prosody features**?

1.2. To what extent does collaborative CAPT of prosody features enhance Algerian EFL learners' **overall pronunciation comprehensibility**?

2. To what extent does collaborative CAPT of prosody influence Algerian EFL students' required guidance to practice in comparison with individual exposure to the technology?

2.1. To what extent does collaborative CAPT of prosody influence **the amount** of Algerian EFL students' required guidance to practice in comparison with individual exposure to the technology?

2.2. To what extent does collaborative CAPT of prosody influence **the type** of Algerian EFL students' required guidance to practice in comparison with individual exposure to the technology?

3. How do Algerian EFL students perceive of collaborative and individual CAPT of prosody features?

3.1. How do Algerian EFL students perceive **the ease of use** of collaborative and individual CAPT of prosody features?

3.2. How do Algeria EFL students perceive **the usefulness** of collaborative and individual CAPT of prosody features?

The research questions are addressed to explore the potential linguistic, technical, and psychological potentials of collaborative CAPT and their influence on Algerian EFL students' pronunciation learning, their training process with the technology, and their perceptions towards it through a mixed-methods approach. The first question attempts to examine the extent to which collaborative CAPT of prosody would enhance Algerian EFL students' use of syllable stress, sentence stress, intonation, and their overall pronunciation comprehensibility. This question requires the use of objective quantitative tools that track the pronunciation learning before and after the study. It is mainly addressed to explore the learning benefits resulting from a sociocultural inspired collaborative CAPT environment in which Algerian EFL students would able to assist each other in interpreting the visual representations of prosody in ASR based CAPT systems and engage in negotiation of meaning instances to facilitate and discuss their perception and production of prosody (Bitchener, 2004; Jeon-Ellis et al., 2005). The learning benefits of such promising practice environment are, therefore, worth investigating especially considering the importance of prosody use and comprehensible pronunciation for Algerian EFL students in the job market (Belmihoub, 2017; Nadia, 2011).

The second question explores the extent to which collaborative exposure to CAPT could influence Algerian EFL students' need for guidance. This question is addressed to investigate the promises of a sociocultural inspired collaborative CAPT in creating an environment that would help Algerian EFL students to tackle the technical, linguistic, and motivational challenges of CAPT with their peers. This question relies on direct observation tools through which the effectiveness of the collaborative CAPT environment, as Smagorinsky (2012, p. 56) suggests, can be investigated by generating insights on the amount and type of support students would require from their peers and the teacher. Such results would highlight the amount and type of challenges which Algerian EFL students are able to tackle through collaboration and those which require the teacher's support in spite of collaboration at the computer.

The third question explores Algerian EFL students' perceptions towards the ease of use and usefulness of the CAPT technology under a collaborative access mode. This question requires systematic data collection tools that help in eliciting the opinions of students about collaborative CAPT. The answers to this question would provide first-hand insights into the extent to which Algerian EFL students found such access to CAPT helpful in facilitating the use of the technology and contributing to its perceived usefulness. The investigation of students' perception, as argued in Hsu (2016), is important as it sheds light on the extent to which the integration of a particular CALL technology is successful.

The following chapter details the methodological approach and data collection tools used in this study to answer the questions addressed above.

Chapter Three: Methodology

While the previous CAPT literature took mainly an individualistic approach when investigating CAPT of prosody features with EFL students (Chiu et al., 2007; Hincks & Edlund, 2009; Seferoğlu, 2005; Tanner & Landon, 2009), the aim of the current study is to explore the collaborative CAPT of prosody features with Algerian EFL students. To do that, the current study adopted a quasi-experimental design in which 18 Algerian EFL students took part in six weeks of CAPT of prosody features using the sentence pronunciation activities in the language learning program Tell Me More. Participants were divided into two experimental groups, a collaborative CAPT group and an individual CAPT group to explore collaborative CAPT, and one control group receiving no treatment to explore the effectiveness of CAPT.

Since the previous research has mainly investigated collaborative access modes through quantitative approaches (Elimat & AbuSeileek, 2014; Luo, 2016; Tsai, 2015), the current study employs a mixed-method approach to explore the collaborative practice of prosody in CAPT. Such pragmatic approach would not only allow the generation of quantitative results assessing EFL students' pronunciation learning, but also provide insights into the narrative of collaborative practice in CAPT (Creswell & Creswell, 2017, p. 203; Dörnyei, 2007, p. 163). This approach, therefore, helps in providing the necessary data to answer the three main research questions of the study addressing the influence of collaborative CAPT of prosody on Algerian EFL students' 1) pronunciation learning, 2) amount and type of required support, and 3) perceptions towards the technology.

The current chapter introduces, explains, and justifies the methodology employed to answer the three research questions posed in the current thesis. The chapter is divided into seven main sections addressing four main parts of the current research's methodology: 1) study design, 2) data collection, 3) data analysis, and 4) ethics and trustworthiness of the study. The first part of the chapter presents the quasi-experimental design employed in this study introducing the context, participants, groups of the study and the training procedures. The second section introduces the research strategy and the data collection tools employed to generate the necessary results. The third section describes the pilot study, its procedures, and implications for the main study. The fourth section presents the ethical considerations taken in the current study. The fifth section details the data collection procedures in the main study. The sixth section details the data analysis employed with quantitative and qualitative data. Finally, the seventh section presents the measures taken to ensure the reliability, validity, and trustworthiness of the results generated in the current study.

3.1 Study Design

The current study adopted a quasi-experimental design to explore the collaborative practice of prosody in CAPT. Such design has been implemented given to the nature of study which is addressing pronunciation learning that has been shown to be affected by both different factors, namely: pronunciation input, opportunities to practice, corrective feedback, motivation and engagement, and age (Derwing & Munro, 2015, p. 31; Neri, Cucchiarini, Strik, et al., 2002) (see **Chapter 2**, Section 2.1.4). The quasi-experimental approach allowed for the manipulation of **the independent variable** in this study (**i.e.** collaborative access of Algerian EFL students to the technology) to assess its influence on **the dependent variable** (**i.e.** computer-assisted pronunciation training (CAPT) of prosody features). This first section of the methodology chapter introduces, explains, and justifies the design of the current study.

3.1.1 Study context and participants

3.1.1.1 Context

The current study took place in the English Department at the University of Biskra in Algeria. This university is located in the province of Biskra which is geographically situated 250 miles south-east of the country's capital city Algiers. The main everyday language in the province is Algerian Arabic (Al Darija) and the official language on the governmental and educational institutions is Modern Standard Arabic (MSA). The university was originally established in 1984 as an institute involving only three departments, namely: irrigation, architecture, and electrical engineering. The institute was further expanded in 1998 to a full university status involving biology, engineering, economics, languages and linguistics, humanities, and social sciences. The creation of the English department at this university, as a sub-program in the Languages department, came as an attempt to meet the increasing demand to learn English in the educational and professional sectors of the province in part and the country as a whole (Belmihoub, 2017) (see **Chapter 2**, Section 2.2.1 The place of English in the Algerian linguistic context).

The English Department at the university offers a Bachelor of Arts (BA) in English Language and Literature program that lasts three years, and two specialized Master's degrees (MA) programs in Applied Linguistics and English Literature each lasting two years. The BA program of English constitutes three years of extensive learning that mainly focus on the acquisition and development of the four language skills (i.e. reading, writing, listening, and speaking). As for the MA program, students are expected to specialize in English Language Literature or Applied Linguistics, receive research methodology courses relevant to their field of specialty, and finally submit a thesis of about 10000 words by the end of the last semester.

According to the university's statistics (2017), in the academic year 2017/8, the English department admitted a total of 701 students to the BA English program and 176 students to the MA programs. The English department sets the English scores 12/20 (equivalent to 60% in the British grading system) in the baccalaureate (aka BAC, refers to end of high school exam) as a minimum requirement for the admission of students to the BA program.

The current study was conducted with participants from the second and third year of the BA English program. The primary reason for choosing to work with such sample is that second and third year students would have prior basic knowledge of English pronunciation and the distinction between phonemic and prosodic features after their first year in the program. Therefore, it was appropriate to work with them as opposed to working with students in the Master's degree program who can be advanced and more invested in their field of specialty than their language skills. English pronunciation is taught in two different modules within the BA English program, namely: the speaking class and the English phonetics class. During the speaking module, teachers pay close attention to students' pronunciation as it is considered an important aspect of communication in the program. As far as the English Phonetics module is concerned, pronunciation is taught mainly focusing on phonemic features through different phonetic transcription activities through which students learn and practice the target language sounds.

The training sessions in the current study took place in the English department classrooms (i.e. normal classes) using the teacher's and students' personal laptops. The laptops were fully equipped with all the hardware and software necessary for the running of the sessions. This included headsets, microphones, and the learning program. The use of laptops was mainly to add an element of flexibility to the training's time and location to avoid the cancelations of sessions in the case of unexpectedly booked rooms by the official program at the department. Additionally, the reason for using laptops was that the IT rooms at the department were rarely used for speaking or pronunciation classes and therefore were not ready for such training. Although the IT rooms at the department were equipped with 10 to 12 PCs that run on Windows 7, many computer devices had audio and display issues that would have interrupted the training sessions.

3.1.1.2 Participants

This study recruited a total of 18 adult English as foreign language (EFL) students (7 males and 11 females) drawn from the second and third year of the BA English (undergraduate) program at the University of Biskra. The participants were native speakers of Arabic aged between 18 to 23 who have been studying English at least for seven years throughout their journey from

middle school, high school to university. The English language proficiency level of participants ranged from pre-intermediate to intermediate as all the participants had to achieve an English score of least 10/20 during their BAC exam. In comparison to the criteria of the international English language testing system (IELTS), students of this level have a basic command of the four linguistic skills and are able to communicate in simple predictable activities of everyday life. In terms of participants' familiarity with technologies and, based on the reports of the background questionnaire submitted during the recruitment, all of the them owned smartphones and reported having previous experience with using different CALL programs and technologies.

To recruit participants, the current study used the convenience sampling approach. Such recruitment approach, as explained in Mackey and Gass (2015, p. 122), relies on the selection of participants who happen to be available. The primary reason behind employing convenience sampling in the current study was due to the challenges of accessing participants after the start of the semester. It was, therefore necessary, as argued in Cohen, Manion, and Morrison (2007), to recruit "those who happened to be interested" in the study (p. 116). Moreover, this sampling approach has been implemented to minimize the risk of dropouts, especially when taking into account the six weeks duration of the intervention. The recruitments process was conducted by visiting two lectures of the target population whereby the researcher briefly presented the study and explained the roles of the potential participants. By the end of each presentation, students were given a form to record their contact details if they were interested. The following table details the profile information of the participants. It is worth noting that the names used in this table are pseudonyms to protect the anonymity of participants who agreed to the terms and conditions of the consent form (see **Appendix 1**, Consent form).

Table 3.1 Profile information of participants

	Participants	**Age**	**Gender**	**L1**	**Number of years learning English**	**English score in BAC**
Collaborative CAPT group	Maria	22	Female	Arabic	10 years	11.50/20
	Rym	20	Female	Arabic	10 years	13.50/20
	Sarah	19	Female	Arabic	9 years	19.50/20
	Wafa	19	Female	Arabic	9 years	18.00/20
	Ikram	20	Female	Arabic	9 years	15.00/20
	Selma	19	Female	Arabic	9 years	18.00/20
Individual CAPT group	Okba	23	Male	Arabic	10 years	16.00/20
	Issam	21	Male	Arabic	9 years	17.00/20
	Esa	20	Male	Arabic	9 years	13.00/20
	Marwa	20	Female	Arabic	10 years	16.00/20
	Mourad	21	Male	Arabic	10 years	19.00/20
	Riyadh	22	Male	Arabic	10 years	12.50/20
Control group	Bilal	19	Male	Arabic	9 years	12.00/20
	Ismail	22	Male	Arabic	10 years	11.00/20
	Samiah	19	Female	Arabic	9 years	15.00/20
	Farida	19	Female	Arabic	9 years	12.00/20
	Nadia	19	Female	Arabic	9 years	15.00/20
	Imane	20	Female	Arabic	10 years	11.00/20

Note. All of the participants spoke Algerian Arabic (Al Darija) as their mother tongue and Arabic MSA as their first language.

3.1.2 Study groups and training treatments

Before the start of the intervention, participants were equally divided and randomly assigned into three groups of six students, two experimental groups and one control group. To explore the collaborative access to CAPT, the first experimental group went through a collaborative treatment where every two students practiced with a single computer device, and the second experimental group went through an individual treatment where each student used a single computer device. In order to measure the influence of CAPT on participants' pronunciation learning, a third group was added to serve as a control group where students only took part in the pre-test and post-test phases of the study. Such design of groups allowed the researcher to control the independent variable in this study (collaboration vs individual access to CAPT) using the collaborative and individual CAPT groups and investigate the influence of the CAPT technology itself through the control group. The following section introduces and explains the different groups involved in this study and the treatments they followed throughout the course in further detail.

3.1.2.1 Collaborative CAPT group (experimental group 1)

The collaborative CAPT group, also referred to as the collaborative group, is the first experimental group. In this group, participants practiced prosody features collaboratively with their peers using the CAPT system where every two students were using one computer throughout all of the training sessions. The reason behind designing this learning setup was to create an environment that promotes social interaction between participants. The collaboration promoted in this group is, as defined by Roschelle and Teasley (1995) in the theoretical framework (see **Chapter 2**, Section 2.4.2), "a coordinated synchronous activity that is the result of a continued attempt to construct and maintain a shared concept of a problem" (p. 70). To achieve this form of collaboration, the teacher suggested for participants grant equal practice time to their peers and to help each other tackle the technical and linguistic challenges they face during the training. Aside from these suggestions, there were no specific instructions on how the participants were supposed to collaborate during these activities as this was left to unfold spontaneously throughout the course. This allowed the researcher to explore collaborative access to CAPT by Algerian EFL students in an environment that included more than one participant practicing, mediating the concepts (i.e. prosody features), and interacting with each other in a spontaneous social way.

3.1.2.2 Individual CAPT group (experimental group 2)

The individual CAPT group, also referred to as the individual group, is the second experimental group. In this group, each participant practiced the prosody features individually with the CAPT system throughout all of the training sessions. The reason behind this treatment was to simulate the predominant individualistic approach in the CAPT literature. To simulate such access mode to CAPT, the teacher provided explicit instructions meaning that participants in this group were not permitted to interact with each other while practicing with the CAPT system. Moreover, it was made clear to the participants that if any technical or linguistic guidance was needed, they were allowed to request it from the teacher. This was mainly because such guidance requests are crucial for the classroom observation data targeting the second research question. In the current study, requests for support are vital indicators in exploring the influence of individual versus collaborative access modes to CAPT.

3.1.2.3 Control group

The third group in this study is the control group, also referred to as the no-treatment group. Participants in this group did not take part in the extracurricular CAPT sessions and, therefore, did not receive any kind of treatment apart from attending the pre-test and post-test stages of the study. During the six weeks of the study, the six participants involved in this group were only

attending their normal BA course as their peers in the collaborative and individual CAPT groups. This group was adopted in the current study to serve as a benchmark showing the extent to which practicing prosody in CAPT can enhance the pronunciation of the participants in the collaborative and individual (training) groups in comparison with those who only take part in the pre and post-tests. The following table summarizes the group design of the CAPT intervention conducted for the current study.

Table 3.2 Groups of the study and training treatments

	Collaborative CAPT group	**Individual CAPT group**	**Control group**
Number of participants	6 participants	6 participants	6 participants
CAPT treatment	Collaborative access to the CAPT system Tell Me More	Individual access to the CAPT system Tell Me More	No treatment
Duration	Six weeks	Six weeks	Six weeks

3.1.3 The role of the teacher (facilitator)

In the current study, the training sessions were delivered by the researcher of the current study. This was mainly due to the unavailability of a teacher who is familiar with ASR based CAPT technology and the design of the training sessions. It is essential to point out that the role of the teacher during the training sessions was limited to facilitating the use of the CAPT system (i.e. Tell Me More) for participants to practice prosody features through sentence pronunciation activities. This is mainly because the current study aims to investigate the influence of access mode to CAPT (collaborative and individual) on the amount and type of assistance required by Algerian EFL students and their perceptions towards the technology. Therefore, participants (under the two training conditions equally) were only provided with an introduction to the use of the CAPT system Tell Me More. This is to allow participants to use the CAPT system. Moreover, the teacher did not have to provide a detailed explanation of the prosody features to the participants of the study. While they don't receive opportunities for explicit prosody practice in their regular course, participants confirmed that they were already introduced to them at different points in their Phonetics and Oral Expression modules. Therefore, the teacher briefly introduced prosody features (syllable stress, sentence stress, and intonation) while focusing mainly on explaining their visual representations in the CAPT system.

3.1.4 Training software

The current study used the sentence pronunciation activities in the commercial language learning program Tell Me More English v10 (10 language levels) as the main training software. The English language learning program was originally developed by Auralog and is currently

owned by Rosetta Stone software developers since 2013. The program offers a variety of speaking skill lessons and activities including word level and sentence level pronunciation activities (Yunus, Hashim, Embi, & Lubis, 2010). Such pronunciation activities adopt the ASR (explained in **Chapter 2**, section 3) to provide English pronunciation input, self-paced practice, and immediate personalized feedback (Lafford, 2004). The main reason for choosing such a language learning program was due to its rich pronunciation input for different English proficiency levels. This helped in employing sentence pronunciation activities that fit the language level of participants in the current study (pre-intermediate to intermediate). In addition to that, the software received many positive reviews on its ASR based CAPT system (Yunus et al., 2010). Unlike many of the ASR based CAPT technologies available today like MyET, Duolingo, and Babbel, the ASR system in Tell Me More showed a decent consistency with human detection of errors and rating of pronunciation (Bajorek, 2017). Moreover, and unlike its competitor MyET, Tell Me More offers the option to training without requiring internet connectivity. This motivated the implementation of Tell Me More given the technical limitation in the context of the study. The figure below presents a snapshot of the software used in the study.

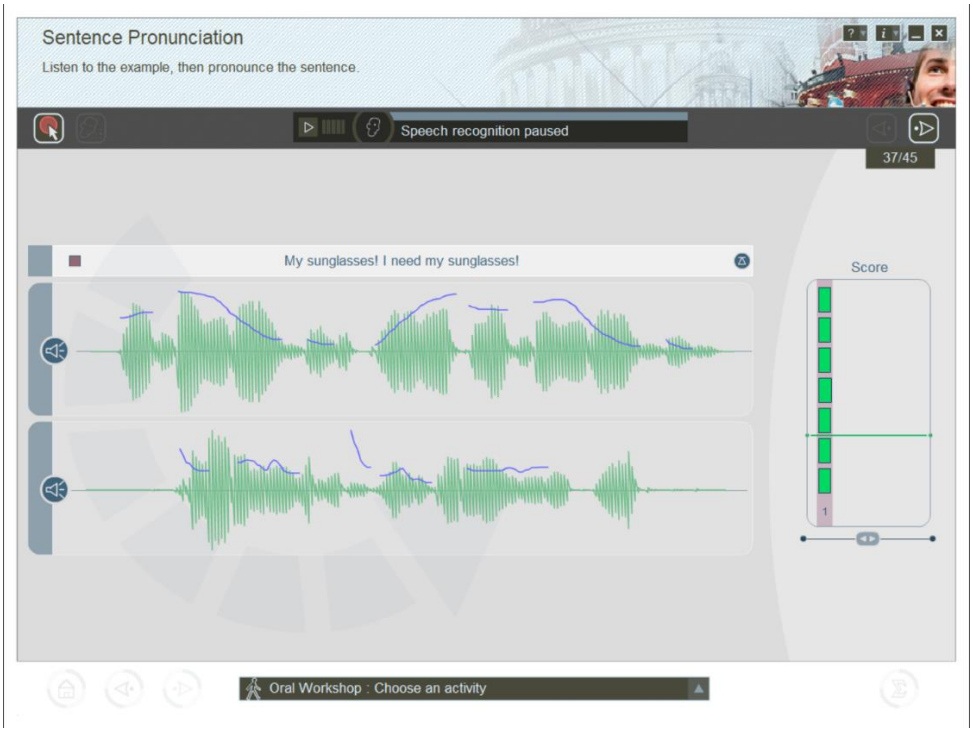


Figure 3.1 A snapshot of the training software used in the study.

In the current study, the training sessions used two types of activities: "*listen and repeat*" and "*listen and choose the correct answer*". The first was the predominant activity during the course as it provided detailed feedback on pronunciation; meanwhile, the latter was introduced in the last session as a different way of practicing prosody with CAPT. As the name

suggests, the "*listen and repeat*" type of activities in ASR based CAPT requires participants to listen to and repeat a set of audio models of sentences revolving around a theme (e.g. sports, travel, food). Meanwhile, the "*listen and choose the correct answers*" activities require the participants to listen to a brief recording about a particular theme or topic and then provide different statements for participants to which they are expected to choose an appropriate reply (note that there are no right or wrong answers to such activities as they only serve as a stimuli for participants to produce output). Such activities were chosen as they represent the predominant type of prosody practice in ASR based CAPT systems (Bajorek, 2017; Yu et al., 2016). Moreover, and while such type of CAPT activities are often criticized for employing a drilling practice approach and failing to simulate spontaneous everyday interactions (R. Jones, 1997; Neri, Mich, Gerosa, & Giuliani, 2008), they do expose students to varied pronunciation input and give them flexible practice opportunities accompanied with a timely feedback that is based on their production.

One activity revolving around a single topic was chosen for each of the six prosody training sessions with the CAPT system Tell Me More. The activities took the following order: "Setting the Table" in the first session, "Window-Shopping" in the second session, "At the Airport" in the third session, "Going on Holiday" in the fourth session, "Diving" in the fifth session, and "Climbing Equipment" in the sixth session. Each activity contained 45 different sentences (see **Appendix 4**, Sentences practiced) that contained a minimum of two words and a maximum of fifteen words. These activities were particularly chosen as they contained sentences that met the minimum language level of the participants (i.e. low intermediate). This was determined by Tell Me More's classification of the sentence pronunciation activities. As it can be noticed from their titles, the activities employed in this CAPT course revolved around a variety of topics. This gave participants the opportunity to practice prosodically rich sentences through different declarative, interrogative, imperative, and expressive statements that can take place in different everyday contexts.

3.1.5 Training procedures

To address the aim of the study, a computer-assisted pronunciation training course took place during the autumn semester of the academic year 2016/2017. The CAPT course consisted of a total of six sessions, each lasting for 60 minutes and focused on the practice of prosody features, namely: syllable stress, sentence stress, and intonation using the sentence pronunciation activities in the language learning program Tell Me More English v10. This training focused on prosody features because of their crucial influence on pronunciation comprehensibility, as evidenced in (Derwing & Munro, 1997; Saito et al., 2016), and because the practice of such

features is often considered as a missing component of Algerian EFL pronunciation instruction (Fethi, 2016) (see **Chapter 2**, Section 2.2.3 The challenges of prosody practice in the Algerian EFL context). The six CAPT sessions were divided into three main phases (See **Appendix 2,** Planning of the training sessions): an introductory session in the first session, a prosody focused CAPT in the second, third, and fourth sessions, and a general prosody practice phase in the fifth and sixth sessions. The following sub-sections detail the training procedures for each session (phase of training) including content, activities, and objectives.

3.1.5.1 Session one: Introduction to CAPT of prosody

The first training session was mainly dedicated to introducing the computer-assisted pronunciation training course and technology to the participants. This included a simplified explanation of the processes of ASR based CAPT technology, the type of pronunciation activities in the ASR based CAPT system Tell Me More, and a first-hand CAPT practical experience for students with the technology. In addition to introducing participants to the brief CAPT course, such an introductory session was delivered to meet the recommendations of the previous CAPT literature highlighting the importance of increasing students' familiarity with the CAPT technology for effective pronunciation practice (e.g. Anderson-Hsieh, 1994; Hansen, 2006). Such familiarity helps to eliminate the basic technical hurdles that might face students and enables them to use the software appropriately for pronunciation practice.

The introductory session started with a brief 15 minutes PowerPoint presentation (see **Appendix 2,** 7.2.1 Session one) that briefly introduced the concept of ASR based CAPT, simply explained its technical processes, and the types of CAPT activities offered by such technology. Participants were made aware that the ASR based CAPT platform used in this study differs from other technologies that can be used for pronunciation practice in that it employs automatic speech recognition. To explain this, the presentation included a simplified representation of the processes in ASR based CAPT to raise students' awareness of how such platforms recognize and analyze their pronunciation output. This part of the introductory session explained the visual representations of the three prosody features syllable stress, sentence stress, and intonation. In addition to explaining its process, this section highlighted the advantages of ASR based CAPT focusing on the unlimited input, self-paced practice, immediate personalized feedback, and free stress environment. The last part of the presentation introduced the variety of pronunciation practice activities in this technology emphasizing the two types of activities implemented in the study: "listen and repeat" and "listen and choose the correct answer".

The second part of the introductory session included a 15 minutes practical introduction to the CAPT system Tell Me More. This was to provide students with a first-hand experience

with the technology's activities and to familiarize them with its user interface (UI) and visual representations of prosody features. During this second part of the session, participants were given the chance to browse the software that was introduced to choose a random sentence pronunciation activity and start practicing. Participants were reminded that the teacher can only be requested for assistance if participants were not able to overcome an issue on their own, in the case of the individual CAPT group, or with their peers, in the case of the collaborative CAPT group. The aim of this activity was to supplement the theoretical introduction of CAPT by practical experience and to ensure that they can use the program Tell Me More to practice pronunciation. Moreover, this was a chance for participants to experience the visual representations with their own pronunciation output. This allowed them to see how the visual features in CAPT, namely: soundwaves and intonation line, represent the models and change with their pronunciation production.

By the end of the 15 minutes practical introduction to the CAPT program, the remaining 30 minutes of the training session were dedicated to sentence pronunciation practice with the CAPT system Tell Me More. The activity was not dedicated to practicing specific prosody features as it was mainly aimed at allowing students to further understand the speech recognition, speech processing, and speech visual representation in CAPT through the sentence pronunciation activity. The activity selected for this first session was entitled "Setting the Table" and revolved around a discussion between members of a family to organize the dinner table. The activity contained 45 different sentences (see **Appendix** 4, 7.4.1 Session one) and involved a minimum of two words to a maximum of ten words including declarative, interrogative, exclamatory, and imperative statements. Participants in the two training groups were asked to complete the "listen and repeat" activity. Once students finish with the "listen and repeat" activity they can move to the "listen and choose the correct answer" activity. There was no limit on the amount of sentence practiced by students. In the cases where students finished both the "listen & repeat" and "listen & choose the correct answer", they were allowed to keep practicing on their pace until the end of the session.

3.1.5.2 Prosody focused CAPT: (Sessions 2, 3, and 4)

The second phase of the CAPT training took place during the second, third, and fourth sessions and was focused on the practice of the different prosody features in CAPT. While participants in this study were already familiar with prosody features (thanks to their phonetics module) and some language learning technologies, not all of them were familiar with the practice of such features using ASR based CAPT systems. Therefore, these sessions were aimed at raising

students' awareness of how prosody features are represented in ASR based CAPT and how they can be practiced with such technology

The three sessions started by refreshing participants' memory of each prosody features. This involved 5 minutes PowerPoint presentations about syllable stress in the second sessions, intonation in the third sessions, and sentence stress in the fourth session. The presentations defined each of the prosody features (in accordance with the definitions in this thesis) and explained their influence on meaning in English pronunciation (see **Appendix 2,** Sessions two, three, and four). This was followed by warmup listening activities that lasted for up to 10 minutes in each of the three sessions. The activities revolved around listening to audio recordings and highlighting the place of syllable stress in the second session, the direction of intonation in the third session, and sentence stress in the fourth session. The aim of these activities was to raise participants' awareness of such prosody features through authentic audio recordings.

Once the warm-up activities are finished in the three sessions, an explanation of the visual representation of the prosodic features in ASR based CAPT was provided. This explanation was delivered using PowerPoint slides while using the CAPT system Tell Me More. This was to make students able to interpret and understand the speech visualization and feedback about each of the prosody features while engaged in CAPT. Such parts of the prosody focused sessions were conducted with Tell Me More's listen and repeat activities planned for these sessions: "Window-Shopping" in the second session addressing syllable stress, "At the Airport" in the third session addressing intonation, and the activity "Going on Holiday" in the fourth session addressing sentence stress. Participants were asked to choose a random sentence and notice the amplitude of soundwaves indicating stress and the blue line indicating intonation and how they were changing with their output.

Once participants showed that they understood the visual representations of prosody in CAPT, the practice of sentence pronunciation start. The practice in each of the three sessions prioritized the focus on a single prosody feature while not ignoring the other features. This was to further assure that participants were able to interpret the visual feedback correctly as the training progresses. The practice with the CAPT system lasted 40 minutes in each of the three sessions. In each of the three sessions participants practiced a total of 45 different in both "listen and repeat" and "listen and choose the correct answer" formats. Although the sessions started with the "listen & repeat activity" to ensure the practice of all the sentences before moving to the "listen & choose the correct answer", participants in the two groups were given the freedom to practice at their own pace until the end of the session.

3.1.5.3 Global sentence CAPT: Session 5 and 6

The third phase of the CAPT course took place during the fifth and sixth sessions and was dedicated to the global practice of sentence pronunciation. By the fifth session, the participants were familiar with the basics of using the CAPT system Tell Me More and its representation of prosody features. Therefore, the last two sessions of the CAPT course gave participants more freedom in their practice of prosody features through global sentence pronunciation activities. Such freedom was provided to give students a chance to work on their pronunciation problems and use of prosody features on without restricting them by focusing on one feature and its visual representation. Similar to the previous sessions, the fifth and sixth sessions employed sentence pronunciation both "listen and repeat" and "listen and choose the correct answer" activities (see **Appendix 2** & **4**, Sessions five and six). Moreover, participants were advised to start by finishing the 45 sentences in the "listen and repeat activities" before moving to the "listen and choose the correct answer" activity as this allows them to practice the 45 different sentences of the activity. The following table summarizes the training procedures in this study.

Table 3.3 Training procedures

Sessions	**Content**	**Activity in Tell Me More**	**Duration**
Session one	Introduction to CAPT	Setting the table	60 minutes
Session two	Syllable stress in CAPT	Window-shopping	60 minutes
Session three	Intonation in CAPT	At the airport	60 minutes
Session four	Sentence stress in CAPT	Going on holiday	60 minutes
Session five	Global sentence pronunciation in CAPT	Diving	60 minutes
Session six	Global sentence pronunciation in CAPT	Climbing equipment	60 minutes

3.2 Data Collection Strategy and Tools

The current study took a pragmatic approach to the data collection process. This approach originates from the pragmatic philosophy which, in its ontology, acknowledges the complex nature of reality and suggests that the emphasis should be on the practical effects of ideas (Yvonne Feilzer, 2010). In other words, ideas are true if they can offer solutions to the problems

of the real world. In its epistemology, pragmatism considers any way of thinking and doing research that leads to a solution to the research problem as a useful method. It, therefore, sidesteps the long debate between positivists, which argue for the objective measurement of reality, and constructivists, which emphasize the subjective construction of reality, and proposes a convergence of the two perspectives for a more effective and practical inquiry (Yvonne Feilzer, 2010). This, according to Rorty (1999) (as cited in Yvonne Feilzer, 2010), frees the researcher from ideological constrains and allows him/ her to focus on answering the research questions.

In research methods, pragmatism is especially manifested through the mixed-method approach. Such an approach to data collection combines both quantitative and qualitative data collections tools and analysis for the purpose of delivering the research aims (Creswell & Creswell, 2017, p. 203). The current study employed the concurrent embedded strategy of mixed method approach. Such an approach, as defined by Creswell and Creswell (2017), is characterized by "one data collection phase, during which both quantitative and qualitative data are collected simultaneously" (p. 214). This approach was implemented due to the nature of the study which did not only investigate the influence of collaborative CAPT on pronunciation learning but also attempted to understand its influence on the use of technology and participants' perceptions towards it. On the one hand, the measurement of EFL learners' pronunciation, to investigate the extent to which collaborative CAPT was effective, requires objective assessment and statistical analysis. On the other hand, observing participants' practice with the CAPT technology and exploring their perceptions towards it requires tools that elicits the narrative of the training process.

Following such an approach, the current study employed three data collection tools, namely: read aloud pronunciation tests, classroom observation, learning logs, and interviews. The read-aloud pronunciation test was the only quantitative data collection tool and was designed to measure students' pronunciation learning before and after the study. During the intervention, the CAPT sessions were recorded by a camera and a screen recording software to observe the extent to which collaborative access to the technology could influence the amount and type of support needed by the participants. Finally, to gain insights into the participants' perspectives, learning logs and interviews were designed. The next three subsections present the data collection tools employed in this study in more detail with a rationale for their implementation in the current study.

3.2.1 Measuring pronunciation learning development

To measure the participants' pronunciation development, a pronunciation learning test was conducted before and after the training. The pronunciation test in this study was in the form of a read-aloud activity that took place during the pre-test and post-test phases of the study. This activity, as recommended in Anderson-Hsieh, Johnson, and Koehler (1992), was to facilitate the identification of pronunciation development made by participants in terms of using the prosody features and most importantly their overall comprehensibility. Unlike spontaneous speech activities where participants can provide a variety of uncontrolled pronunciation outputs, read aloud activities offer more control to what students say and allow the research to elicit participants use of the practiced prosody features by choosing the reading texts.

The tests contained two reading materials, the first titled "Life in the country", and was used in the pre-test, and the second titled "Life on Mars", and was used in the post-test (see **Appendix 8** & **9**, The reading texts). While they contained two different topics, the reading texts were both of an intermediate reading level to meet the reading standards of participants determined through their English scores in the BAC exam to create a leveled testing ground for measuring participants' pronunciation. The selection of these texts was, as suggested by Tanner and Landon (2009), to spare the participants the challenge of reading difficulties and let them focus on their pronunciation performance. The readings texts were also chosen based on their richness of prosody features. Each of the two texts contained declarative, interrogative, and exclamatory statements that, if read properly with regard to punctuation, would allow participants to produce the syllable stress, intonation, and sentence stress practiced during the training. Details about the procedures of the pronunciation learning test, its assessment, and analysis are presented in section 3.5.2 and section 3.6.1.

3.2.2 Classroom Observation

To keep track of the training process in the two training groups throughout the intervention, the current study used camera and screen recordings as a tool for observation. Such data collection method, as explained in Cohen et al. (2007, p. 260), enables the researcher to understand the behavior being studied as it happens. The main reason behind employing camera and screen recording tools for observation was to keep track of the amount and type of the required guidance by participants in the collaborative and individual CAPT groups. Since the current study adopts the sociocultural perspective to CAPT, the number of instances for the demand of the teacher's or peers' guidance and their type in the collaborative CAPT group constitute an important indicator of the effectiveness of such access mode to the technology in comparison with the individual access mode (Smagorinsky, 2012, p. 56).

The classroom observation mainly focused on four out of the six training sessions: the second session dealing with syllable stress, the third session dealing with intonation, the fourth session dealing sentence stress, and the fifth session dealing with general prosody practice with the CAPT's sentence pronunciation activities. This is mainly because a large part of the first session was focused on introducing the training program to the participants. Meanwhile, only 30 minutes was focused on practice in the last session as the rest of the session was dedicated to the arrangements of the post-study data collection due to participants' study obligations and convenience. Obtaining the recording of these four sessions, nonetheless, provided concise and precise data that focused primarily on the training process.

The use of a camera and a screen capture program was, as suggested by Mackey and Gass (2015, p. 206), to save audio-video records of the observed behavior and provide longer duration for analysis which enhances the credibility of results. Unlike direct observation, which mainly relies on field notes and their interpretation, audio-video recording allows the researcher to observe the behavior being studied in a more flexible way through pausing and replaying important instances. Moreover, camera recording in the current study allowed the researcher to facilitate the CAPT sessions in the two training groups, collaborative and individual, while keeping the record of the sessions for post-study observation and analysis. The following two subsections introduce and explain the two technological tools used to record and observe the training process, namely, camera recording and screen recording.

3.2.2.1 Camera recording

The classroom observation was conducted using a camera (Nikon Coolpix A100) that was positioned with a tripod at the back of the classroom with a full view of the training participants. The use of this tool was mainly due to practical and analytical reasons. With the absence of a research assistant to record or deliver the sessions, the recordings gave the researcher the ability to keep track of the training sessions while facilitating them. Moreover, the video recordings allowed for a thorough and flexible analysis of the training process as they can be stored and accessed multiple times in the future. Before the start of the recording process, all of the recruited participants in the collaborative CAPT group and the individual CAPT group provided consent to record their practice during the training (see **Appendix 1**, Consent form).

3.2.2.2 Screen recording

The camera recordings were also supplemented with a screen capture software (Windows Microsoft Encoder 4) that kept track of the participants' actual practice with the CAPT system. This was a supplementary data collection tool for triangulation of the classroom observation. It was employed to provide an on-screen perspective to the amount and type of challenges facing

participants in the training groups when using the CAPT system. Moreover, this was to keep track of the number of sentences being practiced and to shed light on any problematic sentences or prosody features in each training group. Similar to camera recordings, the screen recording software was setup for full-screen capture (1080p screen resolution) and was launched before participants started the practice.

3.2.3 Students' perceptions

To have insights about participants' perceptions toward collaborative and individual CAPT, two data collection tools were employed: learning logs, and interviews. The following two sections provide more details about these data collections tools.

3.2.3.1 Learning logs

By the end of each training session during the main study, students in both groups were asked to fill out a learning log. Learning logs, as defined by Boardman, Vaughn, and Klingner (2018), are a written record that provides students with a tool for recording what they are learning" (p. 86). In the current study, this tool was used to gain insights into what participants in each training group have learned from practicing prosody with CAPT technology (individual and collaboratively) and how they practiced and learned. Learning logs were employed for two main reasons, flexibility and effectiveness in generating results (Tsai, 2015). Unlike questionnaires, learning logs offer participants the chance to describe what and how they learned in their own words. Moreover, and unlike questionnaires or interviews which require a longer completion duration, learning logs can be completed by the end of the training sessions while participants' can still remember the training process.

Learning logs were divided into four main sections each containing two writing spaces where participants could report their perceived positive or negative perceptions (see **Appendix 6**, Learning log form). The first section attempted to elicit participants' general impression about the training session. This was to understand the extent to which participants liked their practice with the technology in each training group. The second part of the learning log was dedicated to the learning benefits as perceived by participants in the two training groups. The third section asked participants about the contribution of the CAPT system in their perceived benefits during the practice. Finally, the fourth section was dedicated to reporting any of the shortcoming faced by participants during the training. Such division of the learning log sections was to maximize the generated positive and negative perceptions from participants and to allow them to cover aspects of the training related to their learning and use of the technology.

3.2.3.2 Interviews

By the end of the study, and for the sake of triangulation, three participants from each group volunteered to take part in semi-structured interviews addressing their perceptions towards the prosodic focused CAPT sessions (see **Appendix 7**, Interview questions). The main reason for employing semi-structured interviews after the training was, as suggested by Cohen et al. (2007, p. 349), to elicit elaborated insights about participants' perceptions about their training experience which may have not been addressed in learning logs. For this reason, the interview questions were supplemented by the use of probing techniques, namely, "why" follow-up questions, to avoided restricting participants' answers. Moreover, interviews were chosen as opposed to questionnaires given that learning logs already served as a perception reporting tool through a written format and interviews provided participants with a chance to express their views orally. This is particularly important because, as Mackey and Gass (2015) explained, "some learners are more at ease speaking than writing and are more likely to provide extended answers in a conversational format" (p. 173).

The interviews were mostly divided into three main parts: warmup questions, discussion, and conclusion questions. As a starter, participants were first asked about their general experience of practicing prosody features with CAPT. Besides the main goal of highlighting possible training experience differences between participants practicing individually and collaboratively, this question was posed to facilitate the start of the interview. The following questions mainly targeted participants' perceptions about the three main aspects of CAPT, namely, audio-visual input, practice, and automatic feedback. These questions were posed raise discussions and highlight potential differences in the way in which participants found the technology advantageous or challenging based on their access mode to it. By the end of the interview, participants were also asked about their willingness to use similar technologies for pronunciation training in the future and for what reasons. This was designed to reflect the extent to which learners in both groups found the technology effective and helpful for their pronunciation development and were willing to spend more time using it.

3.3 Pilot Study

Before conducting the main study and employing the data collection tools, the researcher undertook a pilot study. This pilot was conducted for two main reasons, namely, examining the study design and testing the effectiveness of the data collection tools. In terms of the study design, this pilot was expected to show the extent to which this study was feasible by testing the training materials and identify how the CAPT technology fitted in the designed course for this study. As for the data collection tools, this pilot study employed all the designed tools were

employed including classroom observation (through camera recording and screen capture), learning logs, read aloud pronunciation tests and one simulation interview. The aim was to investigate the extent to which these tools provided the information they were designed to generate. Given to the longitudinal nature of the study, the pilot was not intended for generating data to address the research questions. The following subsections of the methodology chapter explain the design, procedures, and the methodological implications of the pilot study.

3.3.1 Pilot study design

Eight EFL students aged between 19 and 37, from different backgrounds took part in a 60 minutes CAPT session that revolved around the practice of sentence stress. Most of the participants were early arrivals to the UK to take English language courses in preparation for their main course at the University of York. In their answers to the background questionnaires, all of the participants engaged in the pilot study reported owning smartphones and having a varied degree of experience with different CALL technologies including those dedicated to speaking. In order to simulate the planned training process properly, the session was setup in a similar way to the context in which the main study took place. Participants were divided into two groups of four, a collaborative CAPT group where participants worked in pairs, and an individual CAPT group where participants worked individually. The pilot study session took place in a computer room at the University of York using the CAPT language learning program "Tell me more".

3.3.2 Pilot study procedures

The pilot sessions took place in the month of July 2016, that is, two months before the main study took place. Before the start of the practice, a brief introduction to suprasegmental pronunciation and CAPT technology was provided during the first 15 minutes of the session. This was also followed by a 5 minutes explanation of sentence stress with a simple warming up listening activity about the topic. The third part of the session was dedicated to practicing two sentence stress activities with CAPT technology, each lasted 15 minutes using Tell me more. The aim of the two activities was mainly to introduce the technology to the participants, to check how it represented the introduced prosody features (i.e. sentence stress), and to give them an opportunity to practice it. By the end of the session, students were given the chance to fill out the learning logs and reflect on what they learned from the session. In addition to that, one student from each group was asked to participate in an interview and to perform the read-aloud pronunciation test.

3.3.3 Implications of the pilot study on the main study

As the main aim of the pilot study was to examine the study design and data collection tools and to reflect on their effectiveness, various changes were applied for the main study. These changes were introduced on the level of the study design and data collection tools for the purpose of enhancing them and having a better understanding on the research issues presented in this study. After a reflection on the running of the pilot study session with both, collaborative and individual treatments, some changes were introduced to the way in which the training was to be delivered in the main study. First, technical difficulties were detected. Therefore, it was necessary to prepare the materials before the start of training sessions to avoid any kind of delay. Additionally, based on students' performance during the pilot study, it was important to remind students that the purpose behind the training activities was not to test their pronunciation abilities. During the pilot study, many students felt the need to achieve perfect results during the sentence stress awareness raising activities and also during CAPT practice activities. Clarifying this issue to participants in the main study created a more relaxing learning environment where participants did not feel pressured. Data collection tools were also amended based on their implementation and the data they generated in the pilot study. These changes were mainly related to the wording and language used in interviews and learning logs. From the piloting of the interviews and learning logs, it was obvious that participants did not understand some of the terminology used in the questions. This was particularly notable in the interviews where participants demanded explanation for some words and expressions that sounded too technical for them. Therefore, the wording of the problematic questions in the interviews and learning logs was simplified to avoid confusion for the participants in the main study. In addition, to ensure the accurate interpretation of the instructions, the participants in the main study were provided with a learning log copy translated into Arabic and were also offered the opportunity to choose to be interviewed in their language of choice. This was also to emphasize to the participants that they were not being evaluated on the basis of their language level but that the focus was on their views toward CAPT.

3.4 Ethical Considerations

The current study was conducted in accordance with the code of practice and standards for ethical research with human participants set out by the University of York (2016). The access to the institution in which the study took place was granted by the head of the English Department at the University before the start of the intervention. This was after signing a consent form that detailed the study purpose, design, and the role of participants in the main study. All of the volunteered adult participants (including pronunciation learning assessors) in the current study

signed a consent form detailing the nature of training sessions, their role during the study, and explained the process of dealing with the data they provided (see **Appendix 1**, Consent form).

The first part of the consent form consisted of a paragraph that explained the nature of the study, the data collection tools employed, as well as highlighted the place of the training sessions. The training sessions were presented to participants as an extra-curricular activity in which they practiced sentence pronunciation in an innovative way through CAPT technology. It was, therefore, made clear to the participants that the extracurricular training sessions were not to influence their learning or mark in the main course in any way. Moreover, the participants were also informed that content presented during the training sessions was not to be in contradiction to the training policies set out by the institution in which the study is took place.

The second part of the consent explained the role of the participants taking part in this study. This section explicitly detailed two main phases of the study in which participants took part, that is, training and data collection. During the six weeks, the participants were expected to attend the sessions and take part in the CAPT activities. It was, however, made clear that their participation in the current study was voluntary and that they could withdraw from the study at any time up to the second week of the training. Moreover, and in return for this, the participants were asked to take part in data collection before, during, and after the training which included: pronunciation learning tests, classroom observation, learning logs, and interviews. All participants were informed that the data would be dealt with anonymously, through pseudonyms, and that they would not be identified as individuals in the final research or any sort of academic publications.

For the purpose of clarity and mutual understanding between the researcher and the participants, all of the above details of the consent form were summarized in the second page of the consent form. This involved six statements which were to be ticked by participants to establish approval and understanding of what taking part of this study involved in case they wanted to skip the detailed part of the form. Before signing their agreement, the participants had the chance to ask further questions related to their involvement in the study. Moreover, they were also provided with two contact details, one of which is for the ethics committee, in case students wanted to raise queries, concerns, or complaints.

3.5 Data Collection Procedures for the Main Study

The main study was conducted at the University of Biskra, Algeria, during the first semester (autumn term) of the academic year 2016/2017 from the 11 of September 2016 until the 15th of December 2016. Two weeks before the start of the study, the researcher sought permission to conduct the study at the Department of English. The access was granted by the Head of the

Department as well as the modules leaders of both the Speaking class and Phonetics class for the BA program after reading and signing a consent form that detailed the study design and the role of participants (see **Appendix 1**, Consent form). After receiving the approval for the study, the following week was dedicated to the recruitment of participants which was conducted by visiting lectures, briefly introducing the study to participants, and collecting contact details from interested participants (phone number or email). The following table summarizes the stages of the data collection procedures of the main study.

Table 3.4 Data collection procedure of the main study

<table>
<tr><td colspan="2"></td><td></td><td colspan="3">Groups of the study</td></tr>
<tr><td>Stages</td><td>Weeks</td><td>Sessions</td><td>Collaborative CAPT group</td><td>Individual CAPT group</td><td>Control group</td></tr>
<tr><td rowspan="2">Pre-training</td><td rowspan="2">Week 0</td><td>/</td><td colspan="3">Consent form and background questionnaire</td></tr>
<tr><td>/</td><td colspan="3">Pronunciation learning pre-test</td></tr>
<tr><td rowspan="6">During intervention</td><td>Week 1</td><td>Introduction</td><td colspan="2" rowspan="6"></td><td rowspan="6">/</td></tr>
<tr><td>Week 2</td><td>Syllable stress</td><td rowspan="5">Classroom observation</td></tr>
<tr><td>Week 3</td><td>Intonation</td><td rowspan="4">Learning logs</td></tr>
<tr><td>Week 4</td><td>Sentence stress</td></tr>
<tr><td>Week 5</td><td>Prosody</td></tr>
<tr><td>Week 6</td><td>Prosody</td></tr>
<tr><td rowspan="2">Post-training</td><td rowspan="2">Week 7</td><td>/</td><td colspan="3">Pronunciation learning post-test</td></tr>
<tr><td>/</td><td colspan="2">Interviews</td><td>/</td></tr>
</table>

Note. /=no training or data collection.

3.5.1 Consent form and background information

Once a considerable number of students showed an interest in the study, they were randomly divided into three groups. One week before the start of the training, the participants were invited for a session to sign the consent form and to complete a background questionnaire (those who were not able to attend the session, completed the forms by the start of the first session). The participants were given enough time to read the consent form and questionnaire carefully and ask any questions related to the study. By the end this session, there was a provisional agreement on the weekly timing of the sessions with the 12 participants in the training groups. Training sessions were scheduled at 11 am on Tuesday and Wednesday, with the collaborative CAPT group meeting on Tuesday, and the individual CAPT group meeting on Wednesday, and lasted for six weeks.

3.5.2 The pronunciation learning tests

The appointments for the pronunciation learning pre-test were scheduled one week before the start of the training through online communication based on the participants' timetable and the free time available to them. A total of 18 participants (12 from the two training groups and 6 from the control group) were invited to take part in the read aloud activity alone or in small groups. There were 2 participants, one from the collaborative CAPT group and one from the individual CAPT group, who were not able to do the pre-test during that week; therefore, they were individually invited to do the test before the start of the first session. The pronunciation learning post-test was scheduled and conducted during the week following the end of the training sessions at the latest.

These read aloud activities for the pre-test and post-test took place in empty classrooms with the presence of a maximum of four participants. This was to minimize background noise that would negatively affect the pronunciation recording and rating process. Moreover, the participants were given 5 minutes to read the text silently and then inform the researcher whenever they were ready to start. The silent reading, as recommended by Tanner and Landon (2009), was to avoid reading difficulties that would hinder the pronunciation evaluation process. Before the start of the read aloud activities, the participants were also reassured that they were not being examined or evaluated on their language level. It was made clear to them that the read aloud activity was only conducted for research purposes in which they would not be identified with their real names.

The main pronunciation recording tool was a laptop microphone (MSI GE 62) using the free open source software for audio recording and editing Audacity. This tool was supplemented by a mobile phone microphone (Samsung Galaxy S6) to avoid losing recording files in the case of technical failures. By the end of the data collection process, the audio recordings of the test were referenced to protect anonymity and were edited by the same recording software to clear any background noise and enhance the audio quality for the rating process. Moreover, to avoid having the same pronunciation output play repeatedly during the evaluation process (which could negatively affect the rating process), random audio samples of 12 to 20 seconds were generated for each participant for both the pre-test and post-test recordings.

3.5.3 Classroom observation

During the training sessions, the current study obtained the full 60 minutes recordings from the two training groups of the second session, focusing on syllable stress, the third session, focusing on intonation, the fourth session, focusing on sentence stress, and the fifth session, addressing the three prosody features through free sentence practice. The classroom recording setup was

prepared before the start of every training session. The main camera was checked regularly during the training. In order to avoid unexpected recording failures, a smartphone device and a memory card replacement were always present during the training. Participants were also made aware of the screen recording software and were asked to notify the teacher if the recording stopped based on the recording red sign on the bottom left of the screen. That being said, no recording failures were faced with camera or screen recording. By the end of every session, the camera and screen recordings were referenced by the number of sessions categorized by the training treatments (individual vs collaborative) and stored in preparation for the analysis process.

3.5.4 Learning logs

By the end of every training session, the learning logs were handed to the participants to reflect on their experience. The learning logs were collected using an A4 paper that was given to participants immediately by the end of every training session to be completed by hand. This was to facilitate the recalling process of the advantages and challenges faced by the participants during the training. Although the learning logs contained the full names of participants, they were encouraged to provide their honest reflections on the sessions. Once completed, the learning logs were handed to the researcher, referenced for anonymity, and categorized based on group type and session number in preparation for the analysis process.

3.5.5 Interviews

The interviews were conducted with participants after the end of the training sessions. The classroom and timing of interviews were decided by participants to accommodate it with their course schedule. Before the start, participants were given the freedom to choose their preferred language (Arabic or English) for ease of conversation. It was also made clear to them that the interview was not conducted to test their English language abilities, but instead was to know more about their opinions toward the training they went through. There were no time restrictions to the interviews and on average they lasted 25 minutes with each participant. Participants were given the choice to start the interviews whenever they felt ready. Once the interviews started, the recording was only stopped when the participants did not have any more information to provide. Interviews were voice recorded using a mobile phone (Samsung Galaxy S6), as this tool was practical and offered flexible options and permanent online connection to save the files. All of the designed questions were asked to all of the participants. In the cases where participants provided brief answer, probing techniques were implemented to extract more details from them. Moreover, a snapshot of the training program was brought to the interviews to facilitate the conversation and address all of the aspects of the CAPT system used during the

training. By the end of each interview, the recording files were categorized by groups and stored for the purposes of data analysis.

3.6 Data Analysis

The data generated in the current study were analyzed based on their nature (quantitative or qualitative) and the research question they were addressing. The quantitative data generated from the read-aloud tests were analyzed in SPSS 24 to generate descriptive statistics, statistical tests, and plots that reflect the pronunciation learning progress of participants as measured by their prosodic quality and overall comprehensibility. On the other hand, a thematic coding approach was employed to analyze the qualitative data generated through classroom observation, learning logs, and interviews (Miles et al., 2014, p. 53). This section of the methodology chapter introduces and explains the data analysis methods which were used with each data collection tool to answer each specific research question.

3.6.1 The analysis of the data generated from the pronunciation learning tests

3.6.1.1 The analysis of participants' use of prosody features

To assess the prosodic quality of participants' pronunciation before and after the intervention, a prosodic coding scheme was established focusing on the three practiced features, namely: syllable stress, sentence stress, and intonation direction. Inspired by the analysis method of Saito, Suzukida, and Sun (2019), prosodic coding relies on experienced listeners' evaluation of participants' use of the prosodic features in obligatory contexts. To do this, listeners who are familiar with the prosodic features being assessed are asked to carefully listen to students' speech recordings and determine whether the features are being used appropriately in the contexts where they were produced. This section explains the creation and the validation of the coding scheme employed in the current study and the assessment procedures that were followed to evaluate participants' use of the practiced features.

In order for the expert coding to be systematic and reliable, it is first necessary to define the criteria on which the three prosodic features (i.e. syllable stress, sentence stress, and intonation direction) are assessed. The coding of syllable stress, as in Saito et al. (2019), relied on counting the number of appropriate and inappropriate uses of syllable stress in multisyllabic words. For example, the primary stress in the word "imagine" is on the second syllable /ɪˈ**mæ**ʤɪn/. In such case, a syllable stress error is counted in the absence of primary stress /ɪˈmæʤɪn/, or an equal primary stress on the three syllables /**ɪˈmæʤɪn**/, or in the case of a misplaced primary stress /ɪˈmæ**ʤɪn**/. In sentence stress, prosodic coding was based on counting the number of appropriate and inappropriate emphasis (stress) on content and function words.

For example, the emphasis in the sentence "The **population** of **British cities** has been **falling** for **years**" is on the content words (population, British, cities, falling, years) and the deemphasis is on the function words (the, of, has been, for). In such a case, an error is counted if the speaker emphasizes the function words or deemphasizes the content words. As for intonation, the coding focused on counting the number of appropriate and inappropriate uses of intonation in relation to the obligatory contexts of the reading texts. For example, the intonation in the sentence "where are the people going?" (↗), is rising. In such a case, the pronunciation of an utterance is deemed inappropriate if the speaker pronounces the sentence with a falling intonation (↘) or a flat intonation (→).

Once the assessment criteria of the prosodic features were clearly defined, a prosodic model was created for the two reading texts (i.e. "A Future in the Country" and "Life on Mars") to serve as a baseline data to compare between students' prosodic quality and the aspired quality in relation to the obligatory contexts. The creation of this model involved a phonetic analysis of the reading texts and the recording of a realistic pronunciation model with an advanced EFL speaker. The phonetic analysis consisted of word class identification, phonetic transcription, and categorization of sentences and utterances based on the punctuation structure. As a start, the texts were read carefully to identify the classes of words relying on the meaning of the words in relation to the context in which they're used. Afterwards, and through the use of the Oxford English Dictionary, the exact placement of the primary stress was identified in relation to the word class. Moreover, the reading texts and the identification of word classes facilitated the preliminary identification of content words (namely: nouns, verbs, adjectives, and adverbs) and function words in the sentences (namely: articles, auxiliaries, demonstratives, prepositions, pronouns, and conjunctions). The punctuation of the reading texts, on the other hand, played an important role in the preliminary determination of the types of sentences (utterances) and consequently the appropriate intonation associated with them. For example, while the simple full stops and commas indicated a pause or an end of a declarative sentence/ utterance (often associated with a falling intonation), ellipses (…) indicated omission of words, exclamation marks (!) indicated expressive statements, and interrogative marks (?) indicated interrogative statements (often associated with a rising intonation).

By the end of the phonetic analysis, the pre-test and post-test texts were equally categorized into 45 multisyllabic words (proper nouns were excluded due to the dispute about their primary stress placement), 13 sentences with content and function words, and 20 utterances with different uses of intonation (see **Appendix 13**, Prosodic coding scheme). The pre-test text (i.e. "A Future in the Country?") contained a total of 133 words, 82 of which were content words, and 51 function words. Out of the 133 total words, 45 were multisyllabic words

containing: 25 nouns, 5 verbs, 5 adjectives, 2 adverbs, and one sentence adverb. Moreover, and based on the analysis, the pre-test text contained 20 sentences and utterances with 22 uses of intonation, 7 of which rising and 15 falling. The post-test text (i.e. "Life on Mars?") contained a total of 153 words, 108 of which were content words, and 45 function words. 45 of the total number of words in this text were multisyllabic containing: 18 nouns, 7 verbs, 7 adjectives, 5 adverbs, 2 pronouns, and one sentence adverb. The post-test text also contained 20 sentences and utterances with 24 intonation variations, 10 of which rising and 14 falling.

The second step of establishing baseline data for the prosodic coding included the creation of a speech model for the reading texts with an advanced EFL speaker. This was to further define and confirm the appropriate uses of prosodic cues defined earlier through the phonetic analysis of the reading texts. This helped in making final decisions about the placement of syllable stress, sentence stress, and the direction of intonation within the texts. Moreover, the recording was conducted to help the assessors make a final decision about participants' elicitation of the prosodic cues by comparing the samples. The recording was conducted with an advanced EFL speaker who has been learning English for at least 16 years and moved to study in the UK (York) for at least five years with an overall IELTS score of 7 and a speaking score of 7. Similar to the read-aloud activities with the participants, the advanced speaker was introduced to the texts and informed that they were expected to perform the prosodic cues highlighted through the topic, sentence structure, and punctuation of the texts. Additionally, and in order to avoid the interference of reading difficulties with pronunciation performance, the speaker was informed to take their time to read the text and start the recording whenever they felt ready. Similar to participants' speech samples, the prosodic model was recorded with the audio editing software "Audacity" using the laptop microphone. Once the recording was finished, the audio file was edited to reduce any background noise and improve the overall audio quality. Finally, the recording was saved as an mp3 file to be used during the assessment.

Once a baseline data for prosody assessment was established, the process of expert coding was carried out by the main researcher of the study and verified for its reliability with an assistant researcher. Both researchers are advanced Algerian EFL speakers who have been learning English for at least 16 years, 12 years in the home country and 4 years in the UK. At the time of the study, both researchers were based in the UK where they moved to pursue their postgraduate studies after achieving the required overall IELTS score (7.0). The reason behind choosing advanced Algerian EFL speakers for prosodic coding was because the analysis was interested in whether participants used the prosodic features appropriately instead of how accented their speech was. According to Saito et al. (2019) assessors who share the same first

language as the students are more qualified to assess their use of prosody as they are more familiar with the variety of EFL speech and therefore can notice any slight changes in their pronunciation. On the other hand, native English speakers or advanced EFL/ ESL speakers from a different background can be distracted by the comprehensibility or accentedness of Algerian EFL pronunciation and therefore may face difficulties when focusing on the prosodic quality.

The first phase of prosodic coding was conducted by the original researcher of the study using the coding scheme established through the phonetic analysis and speech model (see **Appendix 13**, Prosodic coding scheme). This phase included listening carefully to participants' pronunciation and making a decision about their use of syllable stress, sentence stress, and intonation direction. Using Excel, decisions were either appropriate pronunciation (encoded as "1") or inappropriate pronunciation (encoded as "0"). In cases where the decision was difficult to make about the use of a particular feature, the researcher relied on the audio prosodic model. Once the coding is finished, a prosodic error ratio was calculated for each participant on the use of each prosody feature. This was by dividing the number of errors in using a particular prosody feature by its total number of cues in the reading text (see **Appendix 16** & **17**, Prosodic coding results). Once the error ratios for individual participants were calculated, the data were imported into SPSS 24 for descriptive and inferential statistics. This helped in calculating the group error ratio means for each prosody features and for the overall prosody performance for each group. Additionally, and in order to determine any significant differences between the pre-test and post-test results among the three groups, the Kruskal Wallis test was used as the non-parametric alternative to the one-way Anova test due to the small sample size.

The prosodic coding process was then verified for its reliability through an inter-rater reliability (inter-coder) test with the assistant researcher. The assistant researcher was introduced to the study and the goal of prosodic coding with the speech samples. This included a definition of the three main features practiced in the study and the criteria used to assess their use by students in the prosodic coding scheme used in this study (See the definition in **Chapter 2**, Section 2.1.2). The assistant researcher was also provided with the speech model to make decisions in the case of uncertainty about students' prosodic quality. The inter-rater reliability test contained the coding of 12 random speech samples taken from four participants in each group (see **Appendix 14**, Inter-coder agreement test). Each of the 12 recordings was coded in terms of syllable stress, sentence stress, and intonation direction. By the end of the inter-rater test, the coding results of the research assistant were compared with the primary coding results generated by the main researcher using the inter-rater reliability test Cohen's Kappa in SPSS 24. The test results showed substantial inter-rater reliability ($r = .79$).

3.6.1.2 The analysis of participants' pronunciation comprehensibility

A total of nine listeners (also referred to in the thesis as raters) were recruited to assess participants' pronunciation comprehensibility based on the recordings of the pre-test and post-test read-aloud activities. The population of listeners consisted of six native speakers of English (NSs) from the United Kingdom (UK) and three = Algerian non-native speakers of English. All of the NSs listeners had at least an MA university degree, and all of the Algerian NNs had at least an MA in English language literature or linguistics. Moreover, six out of the total number of listeners (3 British NSs, and 3 Algerian NNSs) were considered expert raters as they were trained English teacher at a university level with a formal education about prosody in English. On the other hand, the other three British NSs listeners were considered non-experts or naïve raters as they speak the English language but did not receive advanced formal education on the language and linguistics. This was, therefore, as suggested in Warren, Elgort, and Crabbe (2009), to offer a balanced judgment on the pronunciation of participants by both NSs and NNs. All of the listeners reported having previous experience of oral interactions with NSs as well as NNs and none of them reported having hearing difficulties that could have impeded their rating of the audio recordings.

Given that the current study used read-aloud activities for the pronunciation test, two measures were taken to ensure that the raters do not listen to the same part of the reading text multiple times. First, the nine listeners, as in Neri, Cucchiarini, et al. (2008), were divided into three groups of three each was assigned to evaluate the audio recordings of the pre-test and post-test of one of the groups of the study. Each group of the three groups of listeners contained two native speakers, one expert and one naïve, and one expert Algerian NNS. This measure was taken to ensure a balance of the assessment of the pronunciation output in each of the study groups. Moreover, to ensure that each listener does not listen to the reading of the whole text multiple times, which would affect the rating of overall comprehensibility negatively, random samples of 15 to 20 seconds were generated from the reading of each participant. It was made sure that these samples contained at least the recording of participants reading at least two full sentences. This is to provide audio samples that are long enough for the assessment.

The rating process took place using the online platform for data collection and management Qualtrics (see **Appendix 12**, Comprehensibility rating form). The listeners were granted access to the Qualtrics page containing the rating form and the audio recordings through a password that was privately emailed to them. This platform was chosen as it offered flexibility for the time and place of the rating process for the listeners. Moreover, the platform is compatible with different types of audio file types and offers practical methods for exporting the

results into excel and SPSS 24 files. The rating form contained a set of instructions detailing the concept of comprehensibility being assessed which was meant to be read before starting the evaluation process with the speech samples. Adopting Munro and Derwing's (1997) definition of pronunciation comprehensibility, the listeners were first instructed to assess participants' speech samples based on their judgment of how difficult or easy they understood them (see **Appendix 12**). Accordingly, the rating forms employed the comprehensibility scale used by Derwing and Munro (1997) and Derwing et al. (2014) rating students' pronunciation comprehensibility on a nine points scale where 1 = extremely difficult to understand and 9 = extremely easy to understand. This nine-point scale was employed because of its simple unipolar system (i.e. difficult to understand to easy to understand) and clear adjectives (i.e. extremely) which indicate to the listener that extremely low or high scores are only given in extreme cases and thus decreasing the chance of disagreement.

Moreover, the instruction of the comprehensibility rating form explicitly clarified that the evaluation of participants' speech is primarily concerned with their pronunciation comprehensibility rather than their accentedness, fluency, or grammatical accuracy. This, in compatibility with the evidence in the L2 pronunciation literature (e.g. Derwing & Munro, 2009; Munro & Derwing, 1995), was to highlight the distinction between the concepts of comprehensibility and accentedness and avoid raters associating comprehensibility with accentedness which might lead to unfair judgments of accented yet comprehensible speech. The second part of the rubric also highlighted that fluency and grammatical accuracy were not a priority in the evaluation process of the speech samples. This is mainly because the study employed read-aloud tasks to elicit highly controlled speech leaving a little room for variability in participants' fluency or grammatical accuracy (Crowther, Trofimovich, Isaacs, & Saito, 2015). This is particularly important to highlight as the two reading texts ("Life in the Country?" and "Life on Mars?") were compatible with the language level of the study sample (intermediate). Moreover, the participants were given time to read the texts silently and start the recording of the speech samples whenever they felt ready.

Intelligibility, a term that is often associated with comprehensibility, was not considered in this assessment due to its secondary relation with prosody features (Levis, 2018). Intelligibility, as defined in the current study, refers to the speakers' phonological accuracy (vowels and consonants) which is often evaluated through listener transcription tests instead of scalar ratings (Kang et al., 2018). Meanwhile, the current study is interested in measuring Algerian EFL learners' comprehensibility progress through prosody practice instead of intelligibility. This because EFL learners in the Algerian educational context already receive phonemic focused pronunciation practice and their pronunciation is mainly evaluated on their

phonological accuracy (namely phonetic transcription activities). Therefore, the current study employed scalar comprehensibility rating because it is more related to prosody use than listener transcription tests which are better suited to detecting phonological accuracy.

By the end of the pronunciation evaluation process, the comprehensibility results were exported from Qualtrics into SPSS 24 and Excel sheets where the quantitative data analysis took place. First, an inter-rater agreement test was conducted to show the extent to which the nine listeners did agree on the definition of overall pronunciation comprehensibility in this study. This was by calculating the interclass correlation coefficient (ICC) in SPSS 24 with the rating scores of participants' speech samples. Overall, a substantial agreement was found with an ICC of .711 between the 9 assessors. As for the comprehensibility scores, the current study used both descriptive statistics and non-parametric tests to analyze and provide an in-depth description of the pronunciation comprehensibility results (Cohen et al., 2007). The generated descriptive statistics (see **Appendix 15**, Overall comprehensibility results), therefore, included the mean pre-test and post-test scores of participants and groups, the difference between pre-test and post-test results (diff), and the standard deviation to show the distribution of results in each group (SD). This was to highlight pronunciation learning differences (if any were detected) among or between the groups of the study. The first step of the descriptive analysis was to generate the mean comprehensibility scores from the 9 ratings of each participants' audio sample for both, the pre-test and post-test. This was to confirm that the results generated by the participants in each group were consistent and reflected the training treatment (i.e. individual CAPT or collaborative CAPT), as opposed to a disparity in the results originating from a significant difference in the starting pronunciation level of the participants. This was then followed by generating the group average comprehensibility scores. These results were generated based on the average scores achieved by the six participants in each group to show the pronunciation learning progress under collaborative CAPT, individual CAPT, or no CAPT treatment. Similar to the prosody use results, the Kruskal Wallis test was used to determine any significant differences between the pre-test and post-test results among the three groups. This test was chosen as the non-parametric alternative to the one-way Anova test due to the small sample size (18 participants).

3.6.2 The analysis of the data generated from the classroom observation

3.6.2.1 The analysis of data from camera recordings

During the data analysis stage, the video recordings of the training sessions were imported into the unstructured data analysis software NVivo 11. The videos were first categorized based on the training groups (individual and collaborative), the number of sessions, and the topic of the

training session. The thematic coding approach was implemented to analyze the data obtained from camera recording videos. The thematic approach was adopted to determine the type of support required by participants when practicing prosody with CAPT individual and collaboratively (Miles et al., 2014). The analysis of the camera recordings to generate results related to the amount and type of support in collaborative and individual CAPT used an abductive approach. This approach has combined the deductive approach focusing on instances of support, based on the adopted sociocultural approach which emphasizes the importance of support by a knowledgeable other in learning, with the inductive approach which allowed for discovering the types of support from the emerging themes in the camera recordings. Such approach has given a preliminary framework that defined the issue being focused on (support), while at the same time allowed for noticing emerging themes related to the nature of support required from teachers and peers during individual and collaborative CAPT.

The amount of support in the current study was defined by the frequency of instances that each participant, in either the collaborative CAPT group or individual CAPT group, asked the teacher or a peer (in the case of the collaborative CAPT group) to intervene and facilitate an aspect of using the CAPT system and the teacher or the peer responds. For example, if a participant practicing sentence stress collaboratively required the teacher to resolve an audio issue, this was recorded as one instance of teacher support. In cases where the participant did not require the support of the teacher or a peer and was able to complete the task, instances of support were not recorded. On the other hand, *the type of support* in the current study was defined by the nature of the support provided by the teacher or the peer. For example, if a participant practicing sentence stress collaboratively requires the teacher to resolve an audio issue, this is recorded as an instance of teacher support recorded under the technical support category and under the code of audio issues.

By the end of the thematic coding process, a coding map has been established based on the patterns of frequency and type of support noticed from the camera recordings. Two major categories of support have been established based on the emerging themes of assistance required from the teacher in the two groups and from the peers in the collaborative CAPT group, namely: technical support, and non-technical support. The technical support category was attributed to instances of the teacher or peer support that were targeted at resolving issues related to the use and functioning of the CAPT system. The use issues included support for browsing the CAPT system's activities and support for accessing the advanced feedback functions in CAPT, while the functioning issues included support to overcome display and audio problems that originated from the software or hardware available during training. As for the non-technical support category, it was attributed to instances of the teacher or peer support that were targeted at

resolving issues related to the practice of prosody features and are not related to the use or function of the CAPT system. Such issues included clarifications for the CAPT activities' instruction, support interpreting CAPT feedback, practice time management with the CAPT system, and emotional support for participants. Such categories of technical and non-technical support are explained in more detail in the results chapter. Finally, and in preparation for presenting the observation results, the current study employed a quantitative approach to identify and highlight the observable patterns and differences between collaborative and individual CAPT. This approach relied on counting the frequencies of each type of technical or non-technical support instances and presenting them through descriptive statistics. This, as suggested in Trujillo (1986), help to decrease the density of the videos recordings and facilitates the detection of patterns and differences in the classroom observation results in the next chapter. The following figure illustrates the thematic coding tree established after the analysis of the data:

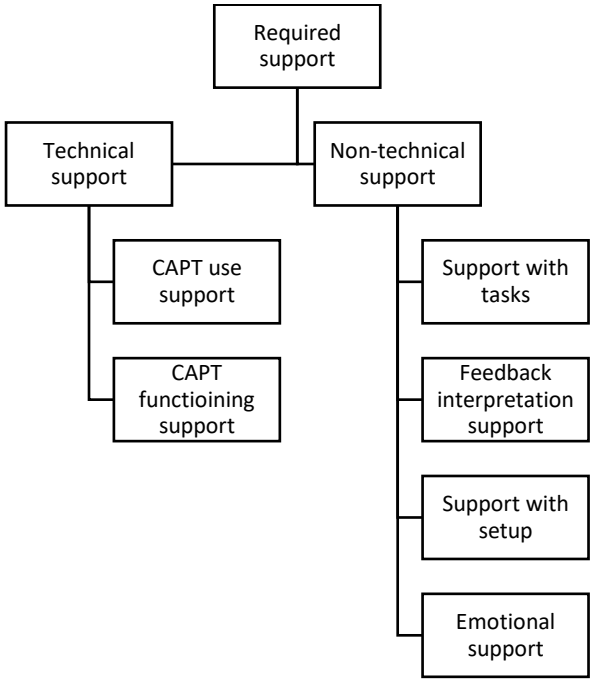


Figure 3.2 The thematic coding plan of camera recordings

3.6.2.2 Consistency of the coding scheme

To test the reliability of the coding scheme of the classroom observation results, a trained assistant researcher was recruited to undertake the coding process again using the same coding plan. The involvement of other researchers to test the analysis process, as suggested by Nunan and David (1992, p. 60) "as cited in (Zohrabi, 2013)", is important to verify the internal reliability of the thematic coding scheme because it tests its consistency in generating results.

The assistant researcher was given a detailed explanation of the study with an emphasis on the research question, data collection tools, and the data of the study for which the analysis is being verified. Before the test starts, random samples of the camera recordings from the training sessions were selected. Moreover, a copy of the coding scheme was handed to the assistant researcher to record the amount and type of support instances. The results of this test showed a moderate similarity of (75.00%) between the coding results of the original researcher and the research assistant.

3.6.2.3 Analysis of the data from the screen recordings

Similar to the camera recordings of the training sessions, the screen capture videos were also imported into the unstructured data analysis software NVivo 11. The videos were also categorized by the number of sessions, the topics of the training sessions, and the treatment conditions. However, unlike the camera recordings of the training sessions, the analysis of the screen capture videos took a computational approach to determine the amount of practice in each group. The amount was determined by the number of sentences practiced which were indicated on the top right corner of the CAPT system's interface. Therefore, to perform the analysis of the amount of practice, a record of the number of practiced sentences, repeated sentences, and skipped sentences was saved.

Since both groups had the same time with the CAPT technology, the amount of practice was determined with the number of sentences practiced using the CAPT program in each session. Every fully performed sentence with the CAPT system was recorded as one sentence. It is worth noting that a recorded sentence is one where the student speaks to the program, wait for the CAPT processing time (usually about one to two seconds) and receives the automatic feedback. The cases in which EFL students skipped some sentences or spoke to the program but did not wait for the CAPT processing time were not recorded.

The repetition of sentences during the practice time with the CAPT technology was a significant part of the training that did not go unnoticed. Such an aspect of practice was important to shed light on how students under the two different treatments conditions practiced with the program. In this study, repetition was defined by the number of times a participant repeated a single sentence when practicing with the CAPT system. In terms of reporting the repetition results, the data were generated from the screen recording videos where repetition was measured in two ways, namely: the number of times participants repeated each single sentence in one activity and the average rate of repeating sentences in each activity.

Another phenomenon that characterized EFL students' practice with the CAPT technology was skipping sentences. Like repeating sentences, it was observed that some EFL

students were skipping some of the sentences in the CAPT activities. As this could shed more light on how EFL students in both groups practiced with the CAPT technology under the two different treatments, the number of skipped sentences was also recorded. A skipped sentence was marked when an EFL student avoided performing a particular sentence provided by the CAPT system or did not give enough time for the learning program to process his/ her speech and to provide the visual feedback.

3.6.3 The analysis of the data generated from the learning logs and interviews

3.6.3.1 Thematic coding analysis

The reports generated from learning logs and interviews were transcribed and imported into the qualitative data analysis software NVivo 11. The data were organized by training sessions (in the case of learning logs), and training groups (collaborative CAPT and individual CAPT). Similar to the analysis of camera recordings, participants' reports were analyzed using thematic coding, with specific themes determined prior to the data analysis. These themes were determined based on the technology acceptance model (TAM). Introduced by Davis (1989), this model looks at learners' perceptions toward a particular technology relying on two indicators (themes): perceived usefulness (PU), and perceived ease of use (PEU). PU refers to the degree to which a student thinks that practicing with a technology would enhance their job or performance. On the other hand, PEU is defined by the extent to which a student thinks that using a technology was free of effort or challenging. Such model has been previously adopted by Hsu (2016) to explore Taiwanese EFL students' perceptions toward self-access to ASR based CAPT. The model has been shown to be effective in systematically exploring learners' perceptions and precisely highlighting the aspects of CAPT that could be easy to use and useful for the practice of English pronunciation.

Thus, based on the value of the model, the current study adopted the TAM model to shed light on Algerian EFL students' perceptions toward the collaborative and individual access to CAPT. To do this, a hybrid of inductive and deductive thematic analysis process was followed to interpret participants PEU and PU. The TAM model provided the primary predetermined framework from which participants answers were classified into two major themes deductively, either PEU or PU reports. Afterwards, an inductive analysis process was followed to infer PU and PEU categories depending on the aspects of CAPT that the participants referred to and were recorded by codes in NVivo. Thus, the primary phase of the analysis was based on the two TAM model's broad perception themes, namely: PEU and PU. Under these two major themes, students' answers were also divided into positive (useful, or easy to use) or negative (not useful, or challenging to use) answers. For example, if a participant

provided a statement in which s/he considered the red highlighting of errors feature in CAPT to be helpful in noticing pronunciation mistakes, this would be considered as a positive PU statement. Similarly, if a participant provided a statement where s/he considered the CAPT software to be challenging or difficult to navigate and use, this would be considered as a negative PEU. To illustrate the analysis, the following excerpts are quotes taken from students' answers to learning logs and interviews and coded into positive and negative PEU and PU:

Positive PEU: "I think the feedback was simple and easy to understand. The visual representation was clear and intuitive" (Okba, interview).

Negative PEU: "It was kind of difficult to browse the program, choose and use the activities in the program … the program was kind of unclear for me" (Mourad, interview).

Positive PU: "I like the program and I like the way it shows us the place of the stress" (Maria, learning log).

Negative PU: "Actually, the score was confusing me. I was too focused with the soundwaves and how to use intonation or stress and rhythm, but the score was not responding that I forgot the goal" (Wafa, learning log).

Under these positive and negative themes, new categories were inductively emerging and then labelled according to the aspects of CAPT technology that participants found useful or not useful for their learning and easy or challenging to use. For example, if a participant provided a statement in which s/he considered red highlighting of errors to be helpful in noticing pronunciation mistakes, this would be thematically coded as a positive PU perception under the category of feedback. Moreover, if a participant provided a statement where s/he considered the CAPT software to be challenging or difficult to navigate and browse, this would be thematically coded as a negative PEU under the category of program navigation.

This, thus, allowed for the identification of contributing features of the program to participants PEU and PU under the two training conditions, collaborative and individual. In terms of the PEU related perceptions, participants in the two training groups reported positive and negative perceptions addressing CAPT system's overall user interface UI navigation, CAPT system's audio-visual input, CAPT system's activities, and CAPT system's feedback. The perceptions under the "CAPT system's overall use and UI navigation" category of PEU refers to participants perceived ability to surf the user interface (UI) of the training program and access its features. The perceptions under the "CAPT system's audio-visual input" category of PEU refer to participants' perception reports about the extent to which they found the program's input (namely the native audio speech samples) easy to understand. The perceptions reported

under the “CAPT system’s activities” category of PEU refer to participants’ perceived ease of understanding and practicing prosody features with the program’s activities. The perceptions under the “CAPT system’s feedback” category of PEU include participants’ perceived ability to interpret and understand the automatic feedback provided by the CAPT system.

As for the PU related perceptions, participants in the two training groups reported positive and negative perceptions addressing the CAPT system’s input, CAPT system’s activities, and CAPT system’s feedback. The perceptions under the “CAPT system’s input” category of PU include participants’ reports of their perceived usefulness (or effectiveness) of the audio-visual input in introducing and illustrating the prosody features practiced during the training. The perceptions under the “CAPT system’s activities” category of PU include participants’ reports of their perceived usefulness of “listen and repeat” and “listen and choose the correct answer” activities during the training. The perceptions under the “CAPT system’s feedback” category of PU include participants’ reports of their perceived usefulness of the automatic and personalized feedback provided by the CAPT system in highlighting and correcting their pronunciation mistakes. The following figure summarizes the plan established to analyze participants’ perceptions towards the CAPT program used in this study.

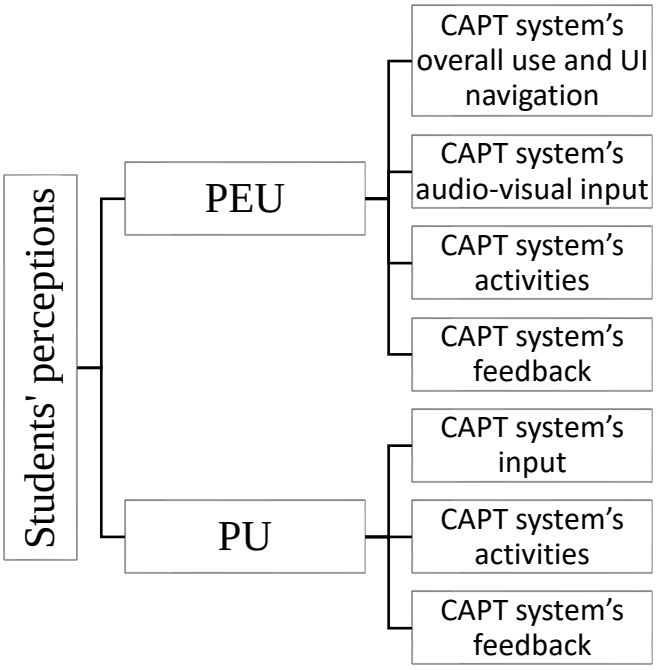


Figure 3.3 The thematic coding plan of participants’ perceptions toward CAPT

3.6.3.2 Consistency of the thematic coding scheme

Similar to the analysis of the camera recordings, the coding scheme of participants’ perception was verified for its reliability through an inter-coder agreement test. This, as suggested in

Nunan and David (1992, p. 60), was to test the extent to which the coding scheme was consistent in generating codes and categories from the perceptions of participants. The test was accomplished by a trained researcher in the field of language education who was introduced to the study design and the data collection tools used to collect participants perceptions. The research assistant was also introduced to the thematic coding scheme used to analyze participants' perceptions and the definitions of its themes (i.e. positive PEU, negative PEU, positive PU, negative PU) and their categories. Before the test starts, 10 random samples were generated from the reports of participants in the learning logs and interviews. The research assistant was then asked to read the reports carefully and use the same thematic coding plan used for the main study to code and categorize participants' perceptions. The research assistant coding results were then compared to the coding results generated in the main study. With a coding similarity of 83.33%, the test results showed a strong agreement between the coding of the main study by the original researcher and the coding of the inter-coder agreement test by the research assistant.

3.6.3.3 The comparison of students' perceptions by training session and group

To compare students' perceptions by groups, collaborative and individual, the current study relied on the frequency within the reports of participants in training with each access mode (Miles et al., 2014, p. 66). Students perceptions were defined by their stance (mention) on each of the PEU and PU aspects of CAPT that were reported in their learning logs and interviews. For example, in the case of participant Okba in the individual CAPT group who reported: "I think the feedback was simple and easy to understand. The visual representation was clear and intuitive", the stance of the participant was addressing a positive PEU related to the ease of interpreting the CAPT system's feedback. Therefore, the report of this participant is considered as one positive PEU mention in the individual CAPT group addressing the "CAPT system's feedback" category.

The frequency of mentions was then used to identify patterns and differences in the perceptions of the two training groups. If a particular positive or negative pattern of mentions is noticed in the PEU or PU reports of participants in a training group, it is then considered as reoccurring perception pattern in that group (Miles et al., 2014, p. 31). For example, if 3 positive mentions on the PEU of the CAPT system's feedback is reported in the collaborative CAPT group, this can reflect that the automatic feedback generated by the technology was generally easy to interpret in this group. This focus on mention frequency helps in identifying the perceptual stance of each training group regarding each of the PEU and PU categories.

The comparison between perception results in the two groups, on the other hand, was determined by the occurrence of statements in each group and their positivity or negativity. For example, if a pattern of PEU or PU reports was noticed only in one training group, that was considered as a distinguished perception theme in that group. If participants in the two training groups provided a high frequency of specific PEU or PU statements, the difference was then determined by the positivity or negativity of reports in each group. If participants in the two training groups provided a high frequency of a specific PEU or PU statements with a similar positivity or negativity, the theme was reported from the two groups without differences. Such an approach was employed to highlight the influence of access mode to CAPT on participants' perceptions on the technology's features.

3.7 Reliability, Validity, and Trustworthiness of the Study

This section of the methodology chapter details the measures taken in the current study to ensure the reliability, validity, and trust worthiness of the data collection tools and results generated in the current study. Since the current study adopted a mixed method approach, both quantitative and qualitative measures of reliability and validity were taken into account (Creswell & Creswell, 2017). This section, therefore, presents the reliability and validity measures taken with the quantitative data collections tools, namely: the pronunciation learning test, and the trustworthiness measures taken with the qualitative data collections tools such as classroom observation, learning logs, and interviews.

3.7.1 Reliability and validity of the pronunciation learning test

3.7.1.1 Reliability of the pronunciation learning test

In quantitative research, reliability refers to the extent to which the data collection tools generate consistent results (Bryman & Cramer, 2005, p. 76). In speech research that employs human raters, this is tested through the inter-rater reliability test. Inter-rater reliability, as defined by Cohen et al. (2007, p. 147), is a measure of reliability that checks the extent to which two or more human raters have established a consensus in evaluating the particular research items. In the current study, since different assessors were recruited to assess the participants' pronunciation in three groups, the intraclass coefficient (ICC) was calculated in SPSS 24. A moderate degree of reliability was found between the assessors in coding participants' use of prosody feature, with an ICC value of .790, and in rating overall comprehensibility, with an ICC value of .711.

3.7.1.2 Validity of the pronunciation learning test

Validity, in its traditional quantitative definition, represents a set of measures that attempt to assess the extent to which data collection tools actually measure what they were designed to measure (Cohen et al., 2007, p. 133). In the current study, a set of measures were taken to ensure the validity of the pronunciation testing and rating tools. The pronunciation learning test in the current study, as in Tanner and Landon (2009), employed reading texts that were designed to meet the language level of participants. Before the start of the reading activity, participants were given enough time to read the text and decide when to start the activity. Additionally, participants were reassured that the activity was conducted for research purposes and that it was not targeted at evaluating their personal language level. Such measures were taken to avoid reading difficulties or anxiety that could have negatively affected their pronunciation output and then hinder the evaluation process.

During the pronunciation evaluation process, it was necessary to agree on the definition of the features being rated, namely: pronunciation comprehensibility, syllable stress, sentence stress, and intonation. However, since it was challenging to bring all of the pronunciation assessors in the same place and time to agree on a single definition for these pronunciation features, as suggested in Tanner and Landon (2009), the current study provided the raters with clear and detailed definitions of these measures before the rating process. Such definitions were derived from the explanations of pronunciation comprehensibility and prosody features as defined in Derwing and Munro (2015) and Reed and Levis (2015). The definitions were also accompanied with examples for further clarification (see **Appendix 14**, Inter-coder agreement test).

3.7.2 Trustworthiness of the qualitative data

3.7.2.1 Credibility

Credibility, as defined in Mackey and Gass (2015, p. 179), refers to the extent to which the qualitative findings in a particular study are credible to the participants engaged in the study and to the readers. Credibility is considered to be the primary characteristic to establish the trustworthiness of qualitative findings as it demonstrates the extent to which they conform with the reality being studied (Shenton, 2004). Two techniques that are often referred to when attempting to establish the credibility of qualitative results are long-term observation and triangulation (Mackey & Gass, 2015; Miles et al., 2014). According to Mackey and Gass (2015), long-term observation (or data collection) increases participants' familiarity with the researcher in person and, therefore, the possibility of eliciting normal spontaneous behaviors from them.

To achieve this, the current study took place over the period of six weeks where participants practiced prosody through CAPT with the researcher acting as a facilitator. Communication with the researcher was also accessible to all of the participants through visits to the context and through the internet. In terms of triangulation, Miles et al. (2014) recommend the use of multiple data collections tools to verify the extent to which they generate "converging conclusions" (p. 250). In its qualitative inquiries, the current study used multiple data collections tools such as camera recordings and screen recordings as tools for classroom observation and learning logs supplemented by interviews to explore students' perceptions. This ensured the availability of the results on each research problem from different angles.

3.7.2.2 Dependability

The trustworthiness measures related to the dependability of research, as explained in Miles et al. (2014), verify the extent to which the data collection and analysis process is consistent and that the results are repeatable. Such criterion of trustworthiness is often examined through the detailed and explicit explanation of the data collection process and analysis with a review from a peer researcher. The current study provided a full description of the tools used to collect information about participants' required support under collaborative and individual CAPT and their perceptions toward the training (see **Chapter 3**, Section 3.2 Data collection tools). Moreover, the data analysis plan was presented with a detailed account for definitions of the concepts being investigated (i.e. amount and type of support, and PEU and PU) and the process followed to generate the necessary results. To further examine the dependability of the qualitative data generated in the current study, the data analysis process of the classroom observation videos and perception reports in the learning logs and interviews were examined by two trained research assistants. The first research assistant examined the thematic coding scheme of the classroom recording videos used to generate results about the amount and type of the support required by EFL students; meanwhile, the second research assistant examined the data analysis plan and process of the learning log and interviews reports used to generate results about participants' perceptions toward collaborative and individual CAPT. Both researchers were handed the coding schemes used by the original researcher for analyzing participants' required support and perceptions, ten random excerpts from the video recordings of the training sessions and participants' reports and enough time for the coding process. The results showed a moderate similarly of 75.00% in coding the camera recordings and a similarity of 83.33 in coding participants perception reports between the original researcher and the research assistants.

3.7.2.3 Transferability

Transferability is a qualitative criterion for the trustworthiness of research findings that is equivalent to the concept of external validity (generalizability) in quantitative research (Cohen et al., 2007, p. 137). The main purpose of transferability is to demonstrate the extent to which the results of a study are generalizable beyond the study sample. However, unlike generalizability in quantitative research, where it is established with large samples and using statistical tests, transferability in qualitative research is demonstrated through providing a detailed description of the study' context and data collection procedures (Cohen et al., 2007; Lincoln & Guba, 1985). This, according to Mackey and Gass (2015), help other researchers to recognize the similarities and differences between contexts and populations of the different studies and the extent to which they relate to their own. Since the current thesis reports an in-depth exploration of collaborative CAPT through a case study, the transferability characteristic has been established through a thick description of the context and the participants of the current study. First, a detailed introduction was presented for the languages and education of Algeria leading to a rationale for the use of CAPT of prosody in its EFL educational context (see **Chapter 2**, Section 2.2). Moreover, the methodology chapter provided a detailed description of participants' linguistic background, education, L2 language level, and familiarity with CALL technologies.

3.7.2.4 Confirmability

Confirmability in qualitative research, as defined by Mackey and Gass (2015), is similar to the concept of replicability in quantitative research as it suggests a detailed explanation of the data collection tools, data collection procedures, and analysis "so that other researchers can examine the data and confirm, modify or reject the first researcher's interpretations" (p. 178). The purpose of confirmability, as explained in Miles et al. (2014), is to highlight the extent to which the presentation of results is free from the researcher's biases. A common technique for establishing confirmability in qualitative research is to make the data collection tools, data analysis procedures, and findings available for other researchers to verify, confirm, or reject the original researcher's interpretation. In this regard, the current study provided a detailed explanation for the procedures through which the results were generated. This included a description of the study design, data collection tools, data collection, and data analysis.

Chapter Four: Results

This chapter presents the findings of the study to address the general aim of exploring collaborative CAPT of prosody. The chapter is divided into three main sections each addressing one of the three research questions of the study. The first section presents the quantitative results of participants' pronunciation learning generated through the read-aloud tests conducted before and after the study. The pronunciation learning results are based on the systematic coding of participants' use of the practiced prosody features (i.e. syllable stress, sentence stress, and intonation) and listener ratings of participants' overall pronunciation comprehensibility. The second section presents the classroom observation results generated through the camera and screen recordings and analyzed using thematic coding. The results in this section address the second research question highlighting the extent to which collaborative CAPT of prosody influences the amount and type of participants' required support in comparison with individual CAPT of prosody. Finally, the third section of the chapter presents the results of participants' perceptions generated through the thematic coding of the learning logs and interviews. These results in this section shed light on participants' perceived ease of use (PEU) and perceived usefulness (PU) of CAPT of prosody through collaborative and individual access modes.

4.1 Participants' Pronunciation Learning Results

Overall, based on the pronunciation assessment of participants' prosody use and overall comprehensibility, no significant pronunciation learning differences were found between the pre-test and post-test and among the three groups. Although some small gains were detected in terms using the practiced prosody features (i.e. syllable stress, sentence stress, and intonation) in the two treatment groups (individual and collaborative), such results did not significantly influence EFL learners' overall pronunciation comprehensibility. This section of the results chapter details the results of the two pronunciation learning measures implemented in the current study, namely: overall prosodic quality (measured through participants' use of syllable stress, sentence stress, and intonation) and overall comprehensibility. The section presents a written and visualized description of the mean, minimum, maximum values for the pronunciation learning results of both individual participants and groups. The results of the non-parametric test (Kruskal-Wallis) are also presented.

4.1.1 Participants' overall prosodic quality results

The results of prosody use derived from the expert prosodic coding showed a slight decrease in the average prosodic error ratio of the collaborative and the individual CAPT groups between the pre-test and post-test and no noticeable development in the control group. The following

table presents the overall prosodic error ratio mean scores in each of the study groups. These results were derived from the results of the expert coding of the three practiced features (i.e. syllable stress, sentence stress, and intonation) (see **Chapter 3**, section 3.6.1 The analysis of participants' prosody use).

Table 4.1 The overall prosodic error ratio results

Groups	***n***	**T1**	**SD**	**Min**	**Max**	**T2**	**SD**	**Min**	**Max**	**Diff**	**df**	**Sig**
CCAPTG	*6*	**.140**	.045	.065	.191	**.112**	.032	.063	.164	**.028**		
ICAPTG	*6*	**.152**	.022	.119	.179	**.110**	.036	.065	.164	**.042**	**2**	**.557**
CG	*6*	**.131**	.028	.073	.151	**.128**	.008	.116	.138	**.003**		

Note. T1 = Pre-test, T2 = Post-test. CCAPTG = Collaborative CAPT group, ICAPTG = Individual CAPT group, CG = Control group.

As shown in Table 4.1, participants in the two treatment groups (i.e. collaborative and individual CAPT groups) made slightly better overall prosody use developments between the pre-test and post-test compared to the no-treatment group (i.e. control group). This was reflected in the slight drop of the overall prosodic error ratio between the tests. In the collaborative CAPT group, the overall prosodic error ratio fell from an average of .140 in the pre-test to an average of .112 in the post-test. In the individual CAPT group, the prosodic error ratio fell from an average of .152 in the pre-test to an average of .110 in the post-test. Meanwhile, the prosodic performance in the control group remained static with an average prosodic error ratio of .131 in the pre-test and an average of .128 in the post-test. The Kruskal-Wallis test was conducted to examine the differences in the development of using prosody features according to the mode of access to the ASR based CAPT technology. The results of the test showed that no significant pronunciation learning differences (Chi square = 1.169, p = .557, df = 2) were found among the three ASR based CAPT treatments (collaborative, individual, and control). To be better understand the insignificant differences in the overall use of prosody features, the following figure provides a detailed illustration of participants' overall prosodic error ratio before and after the study in relation to their mode of access to the CAPT system.

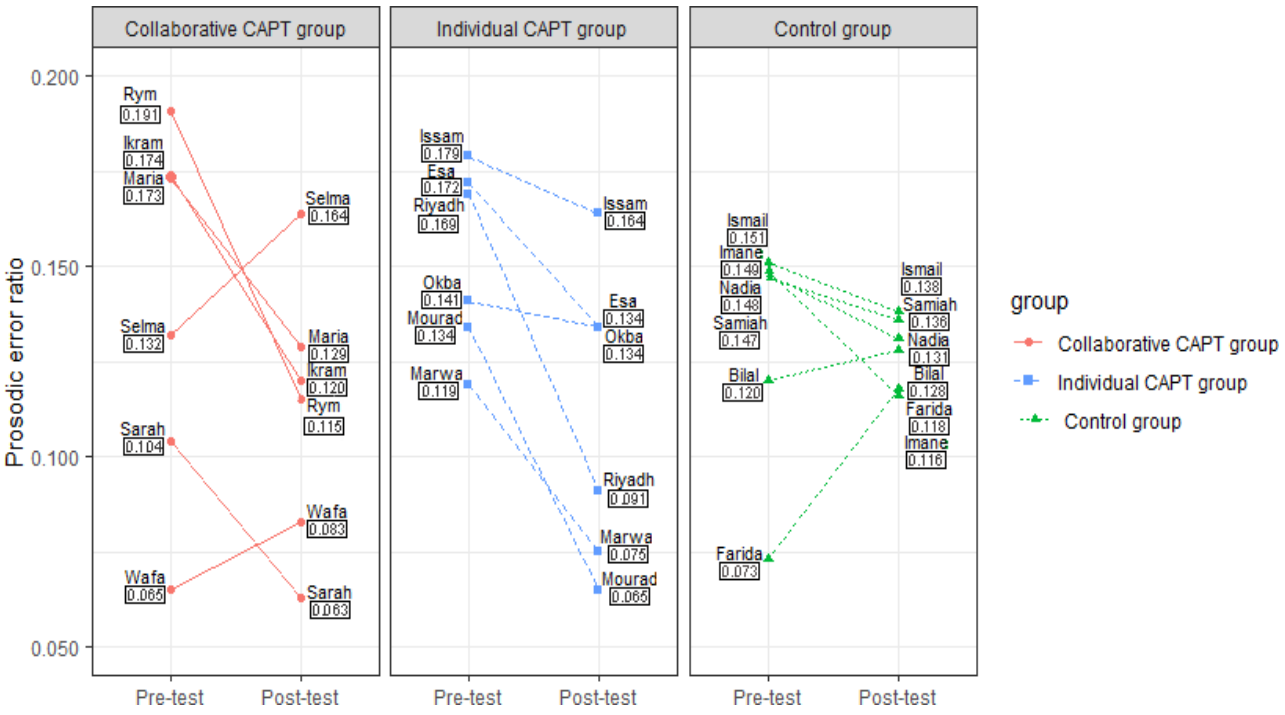


Figure 4.1 Participants' overall prosodic error ratio

Although the overall means for prosodic error ratios shows a slight learning development in the two treatment groups as measured by the decrease in prosodic errors, Figure 4.1 shows that such learning was not consistent with all of the participants. In the collaborative CAPT group, Rym, Ikram, Maria, and Sarah achieved an important decrease in their overall prosodic error ratios ranging between .190 in the pre-test to .051 in the post-test. Meanwhile, the other two participants (Selma and Wafa), and although they took part in the six-weeks training, they marked a slight increase in their overall prosodic error ratio. On the other hand, all of the participants in the individual CAPT group made a slight decrease in their overall prosodic error ratio. The extent of such learning development, however, varied among the six participants. While Issam and Okba made a very small decrease in their prosodic error ratios, the remaining participants made important improvement in their overall use of the practiced prosody features with error ratios ranging from .170 in the pre-test to .051 in the post-test. As for the control group, the overall prosodic error ratio scores for participants did not differ significantly between the two tests. With the exception of Farida, whose overall prosodic error ratio increased from .073 in the pre-test to .118 in the post-test, the results of Ismail, Samiah, Alia, and Bilal remained between an error ratio of .120 as a minimum and .150 as a maximum. The following three sections provide a detailed presentation for participants' prosodic error ratio generated through expert coding for the three practiced prosody features in the study, namely syllable stress, sentence stress, and intonation.

4.1.1.1 Syllable stress

Table 4.2 The overall syllable stress error ratio results by groups

Groups	*n*	T1	SD	Min	Max	T2	SD	Min	Max	Diff	df	Sig
CCAPTG	*6*	**.146**	.078	.022	.267	**.104**	.036	.044	.133	**.042**		
ICAPTG	*6*	**.148**	.021	.111	.178	**.133**	.036	.089	.200	**.015**	**2**	**.261**
CG	*6*	**.126**	.061	.022	.222	**.137**	.015	.111	.156	**-.011**		

Note. T1 = Pre-test, T2 = Post-test. CCAPTG = Collaborative CAPT group, ICAPTG = Individual CAPT group, CG = Control group.

According to the results shown in Table 4.2, the average syllable stress error ratio has decreased in the two training groups. The collaborative CAPT group was the group that made the most leaning development in syllable stress with an average error ratio of .146 in the pre-test and an average error ratio of .104 in the post test (Diff = .042). The individual CAPT group, and while its average syllable stress error ratio has dropped from .148 in the pre-test to an average of .133 in the post test, its improvement (Diff = .015) was less significant than that of the collaborative CAPT group. On the other hand, the use of syllable stress in the control group did not show any improvements as the average error ratio in this group has increased slightly from .126 in the pre-test to an average of .137 in the post-test. To assess the significance of the syllable stress results between the three groups and the two tests, the Kruskal-Wallis test was conducted using SPSS 24. The results of the test showed that no significant syllable stress learning differences (Chi square = 2.688, p = .261, df = 2) were found among the three ASR based CAPT treatments (collaborative, individual, and control). The following graph illustrates participants' syllable stress error ratio trajectory between the pre-test and post-test in relation to their mode of access to the CAPT system.

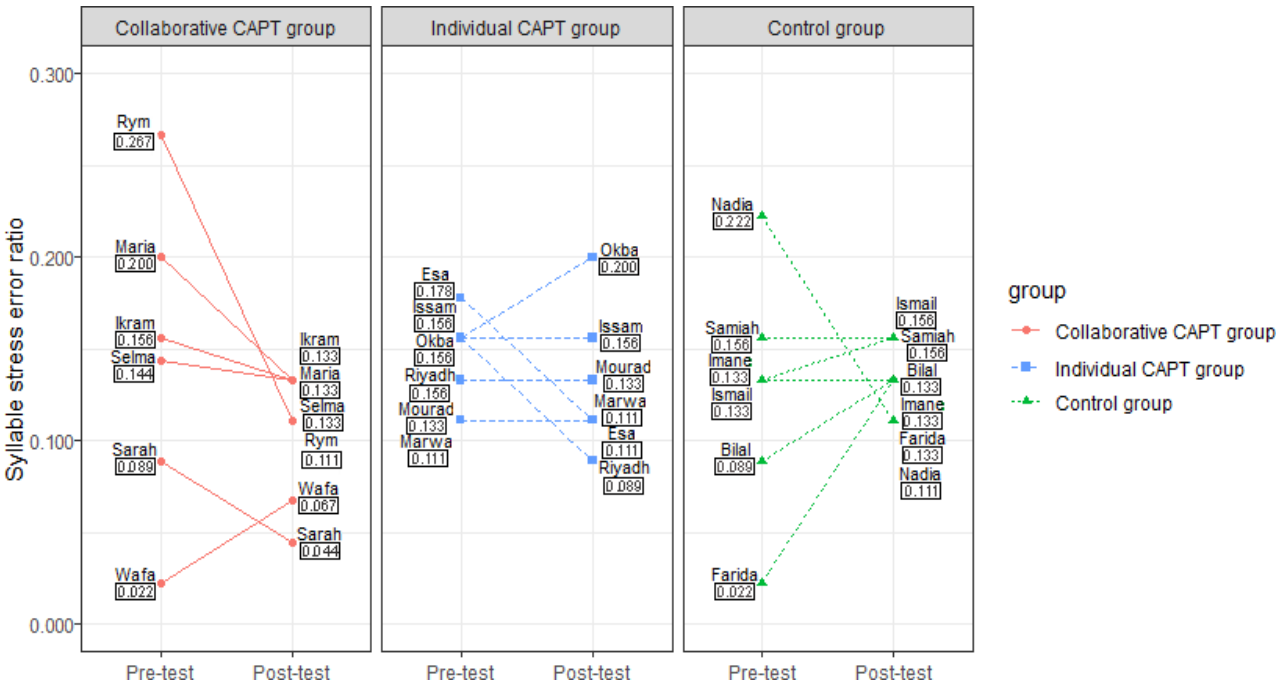


Figure 4.2 Participants' syllable stress error ratios

As was the case with the overall average of prosodic error ratios in Figure 4.1, and while the group averages of syllable stress error ratios showed a slight learning progress, participants' results were not consistent within the groups. With the exception of Wafa, whose syllable error ratio increased slightly from an average of .022 in the pre-test to .067 (Diff = .045) in the post-test, all the remaining participants with collaborative access to CAPT made a varied decrease in their syllable stress error ratio. In the individual CAPT group, only two participants (Esa, Riyadh) achieved a lower syllable stress error ratio in the post-test. Meanwhile, three participants Issam, Mourad, and Marwa achieved the same error ratio of the pre-test (.156, .111, .133 respectively), and one participant (Okba) marked a slight increase in his error ratio (T1 = .156, T2 = .200). As for the control group, only one participant (Alia) was found to have decreased her syllable stress errors with a ratio of .222 in the pre-test to a ratio of .111 in the post-test. The remaining participants either marked an increase in syllable stress error ratio (Bilal, Farida, Ismail), or achieved a similar score to that of the pre-test (Samiah and Souha) with an error ratio of .156 and .133 respectively.

4.1.1.2 Sentence stress

Table 4.3 The overall sentence stress error ratio results by groups

Groups	*n*	T1	SD	Min	Max	T2	SD	Min	Max	Diff	df	Sig
CCAPTG	*6*	**.053**	.023	.023	.083	**.046**	.022	.020	.085	**.007**		
ICAPTG	*6*	**.068**	.024	.045	.113	**.044**	.023	.013	.085	**.024**	**2**	**.725**
CG	*6*	**.035**	.014	.023	.060	**.049**	.012	.026	.065	**-.014**		

Note. T1 = Pre-test, T2 = Post-test. CCAPTG = Collaborative CAPT group, ICAPTG = Individual CAPT group, CG = Control group.

According to the results in Table 4.3, both training groups achieved a slight decrease in their sentence stress error ratios. Unlike syllable stress results, the individual CAPT group achieved slightly higher learning progress in sentence stress when compared to the collaborative CAPT group. The overall sentence stress error ratio in the individual CAPT group slightly decreased from an average of .068 in the pre-test to average .044 in the post-test. On the other hand, the overall sentence stress error ratio in the collaborative CAPT group only decreased by (Diff = .007) from an average of .053 in the pre-test to an average of .046 in the post-test. As for the control group, the sentence stress error ratio marked a slight increase (Diff = -.014) from an average of .035 in the pre-test to an average of .049 in the post-test. After conducting the Kruskal-Wallis test in SPSS 24, however, no significant learning differences (Chi square = .642, p = .725, df = 2) were found between the tests or among the three groups of the study. Participants' sentence stress error ratio results in relation to their mode of access to the CAPT technology are illustrated in the following graph.

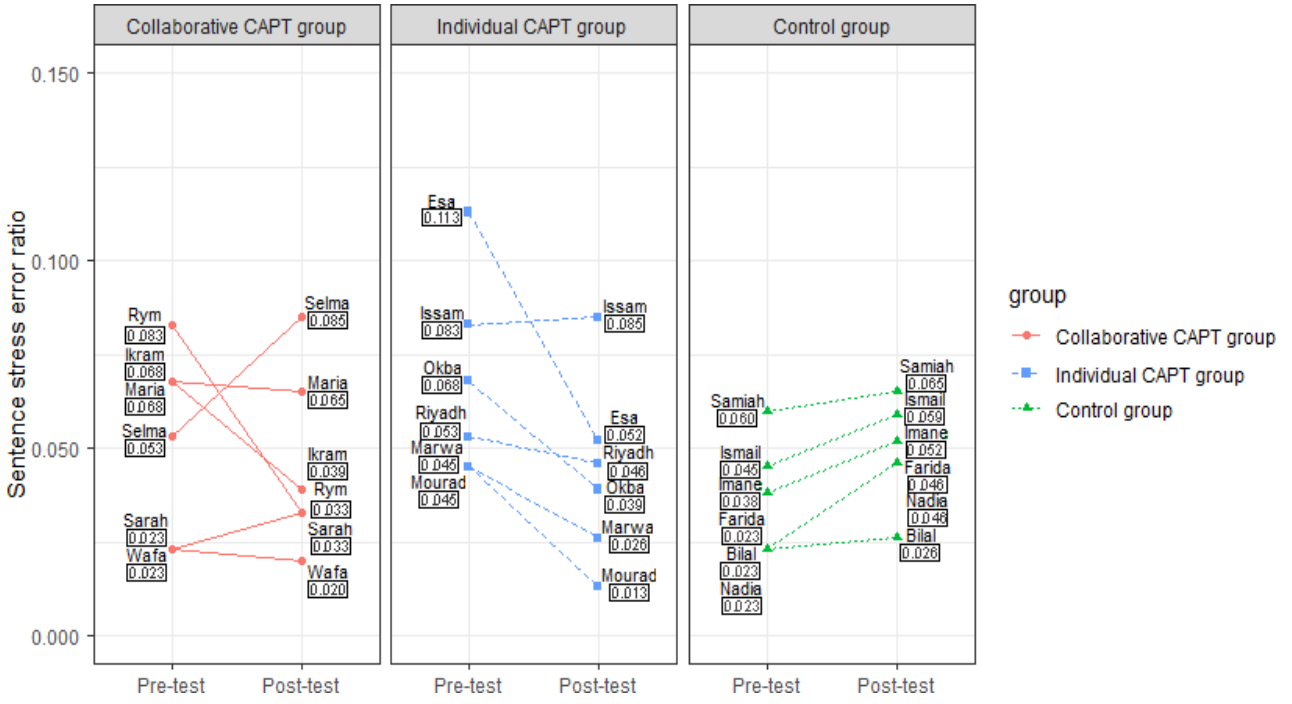


Figure 4.3 Participants' sentence stress error ratios

According to the results of the participants illustrated in Figure 4.3 above, the collaborative CAPT group marked the most inconsistencies of participants' error ratios compared to the individual CAPT group and the control group. Although the six participants went through the same CAPT sessions, only four participants recorded a lower sentence stress error ratio from that of the pre-test. Participants Selma and Sarah scored slightly higher sentence stress error ratios (T2 = .085 and .033 respectively) compared to their pre-test scores (T1 = .053

and .023 respectively). The remaining participants either achieved important sentence stress error ratio drops (Rym and Ikram) or slight error ratio drops (Maria, Wafa). In the individual CAPT group, and except for Issam, whose sentence stress error ratio slightly increased from an average of .083 in the pre-test to an average .085 in the post-test, all of the participants achieved lower sentence stress error ratio scores in their post-test results. As for the control group, all of the participants recorded a slight increase in their sentence stress error ratios in the post-test compared to their scores in the pre-test.

4.1.1.3 Intonation

Table 4.4 The overall intonation error ratio results by groups

Groups	***n***	**T1**	**SD**	**Min**	**Max**	**T2**	**SD**	**Min**	**Max**	**Diff**	**df**	**Sig**
CCAPTG	*6*	**.221**	.047	.150	.300	**.188**	.048	.113	.275	**.033**		
ICAPTG	*6*	**.242**	.042	.200	.300	**.154**	.073	.050	.250	**.088**	**2**	**.523**
CG	*6*	**.233**	.037	.175	.275	**.198**	.026	.163	.238	**.035**		

Note. T1 = Pre-test, T2 = Post-test. CCAPTG = Collaborative CAPT group, ICAPTG = Individual CAPT group, CG = Control group.

In terms of intonation, all of the three groups marked a decrease in the overall intonation error ratio in the post-test. The individual CAPT group made the most learning development in intonation (Diff = .088). The overall error ratio in this group fell from an average of .242 in the pre-test to an average of .154 in the post-test. As for the collaborative CAPT group, the overall error ratio only decreased by (Diff = .033) from an average of .221 in the pre-test to an average of .188 in the post-test. Interestingly, the control group recorded a slight drop in the overall intonation error ratio from an average of .233 in the pre-test to an average of .198 in the post-test. To test the significance of the intonation error ratio results, the Kruskal-Wallis test was conducted in SPSS 24. The results of the test showed no significant differences (Chi square = 1.297, p = .523, df = 2) between the pre-test and post-test in the three groups. The following graph details the participants' intonation error ratio results in relation to their mode of access to the CAPT system.

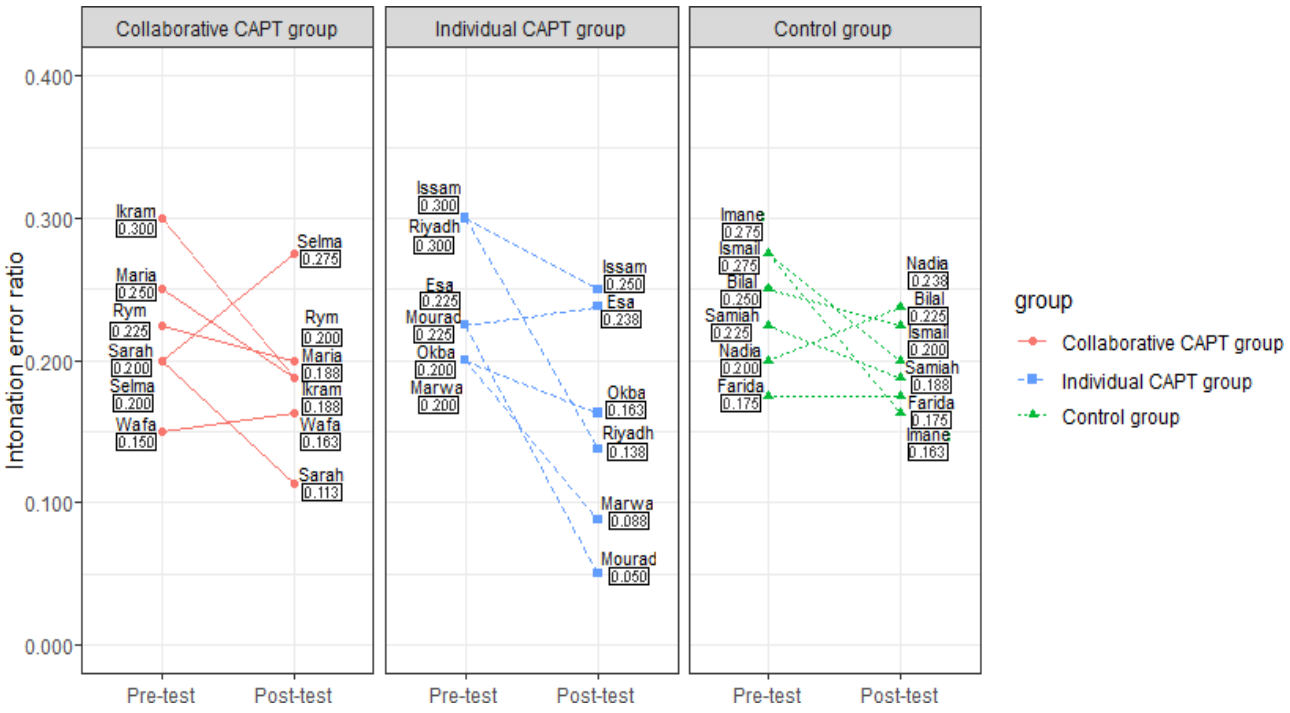


Figure 4.4 Participants' intonation error ratios

In consistency with the group results, five out of the six participants in the individual CAPT group scored a lower intonation error ratio in the post-test. Except for Esa, whose error ratio slightly increased from an average of .225 in the pre-test to an average of .238 in the post-test, the other participants (Issam, Riyadh, Mourad, Okba, Marwa) in this group (individual CAPT group) achieved a slight decrease in their intonation errors. Participants in the collaborative CAPT group, on the other hand, did not record the same consistency. In this group, four participants (namely: Ikram, Maria, Rym, and Sarah) achieved a lower error ratio in the post-test and two participants (Selma, Wafa) were found to have increased their intonation error ratio. In the control group, four participants achieved a drop-in error ratio (Imane, Ismail, Bilal, and Samiah), one participant recorded an increase (Nadia), and one participant scored the same error ratio in both tests (Farida).

4.1.2 Participants' overall comprehensibility results

Table 4.5 The overall comprehensibility results by groups

Groups	*n*	T1	SD	Min	Max	T2	SD	Min	Max	Diff	df	Sig
CCAPTG	*6*	**6.72**	.95	5.67	8.33	**6.28**	1.15	5.00	8.00	**.44**		
ICAPTG	*6*	**6.56**	1.20	5.00	8.67	**6.28**	1.08	4.33	7.33	**.28**	**2**	**.659**
CG	*6*	**6.44**	1.23	4.00	8.00	**5.89**	1.65	4.33	8.67	**.55**		

Note. T1 = Pre-test, T2 = Post-test. CCAPTG = Collaborative CAPT group, ICAPTG = Individual CAPT group, CG = Control group.

Despite the training groups (collaborative and individual) achieving slight (but not significant) learning developments in the use of the three practiced prosody features, such

learning gains did not significantly affect their overall comprehensibility. The three groups of the study recorded a slight drop in their overall comprehensibility scores. The individual CAPT group, which achieved the highest learning progress in overall prosody, recorded its lowest drop in overall comprehensibility from an average of 6.56 (/9) in the pre-test to an average of 6.28 in the post-test. Similarly, the collaborative CAPT group recorded a drop in its overall comprehensibility score from an average of 6.72 in the pre-test to an average of 6.28 in the post-test. The control group receiving no treatment recorded the highest drop in the overall comprehensibility score (Diff = .55). The group's score fell from an average of 6.44 in the pre-test to an average score of 5.89 in the post-test. Given such results, and according to the Kruskal-Wallis test, no significant learning differences (Chi square = .833, p = .659, df = 2) were detected between the three groups in terms of their overall comprehensibility. The comprehensibility scores of individual participants in relation to their group are presented in more detail in Figure 4.5 bellow:

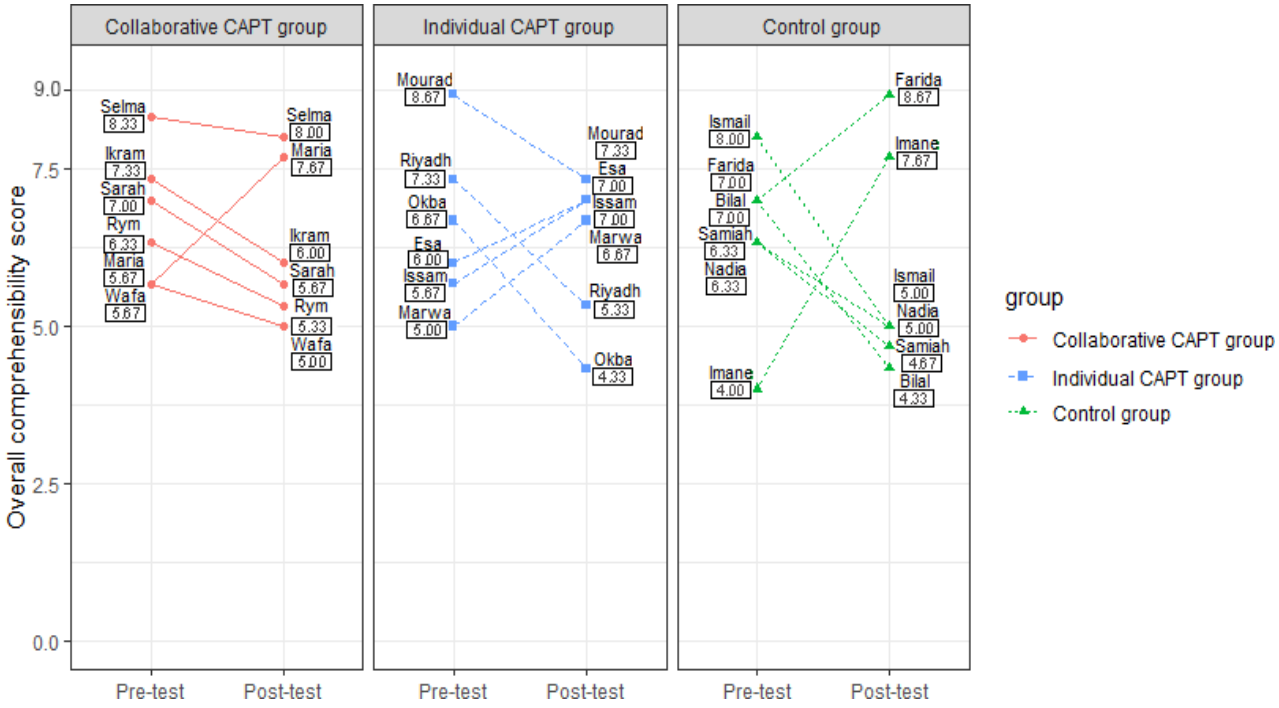


Figure 4.5 Participants' overall comprehensibility scores

Overall, Figure 4.5 show no significant developments in participants' pronunciation comprehensibility between the pre-test and pot-test phases of the study. With the exception of Maria, whose comprehensibility score increased from an average of 5.67 in the pre-test to an average of 7.67 in the post-test, all of the participants in the collaborative CAPT group recorded similar or slight drops in their comprehensibility scores. As for the individual CAPT group, the development of participants' comprehensibility was equally divided between three participants

who recorded an increase in their comprehensibility scores, namely Esa (Pre-test = 6.00, Post-test = 7.00), Issam (Pre-test = 5.67, Post-test = 7.00), and Marwa (Pre-test = 5.00, Post-test = 6.67), and three participants who recorded a decrease, namely Mourad (Pre-test = 8.67, Post-test = 7.33), Riyadh (Pre-test = 7.33, Post-test = 5.33), and Okba (Pre-test = 6.67, Post-test = 4.33). In the control group, four participants (Ismail, Bilal, Samiah, and Alia) recorded a drop in their comprehensibility scores and only two participants (Farida, Souha) recorded an increase in their comprehensibility scores.

4.2 The Results of the Required Support in Collaborative and Individual CAPT

This second section of the results chapter presents the results generated from the thematic coding of classroom observation conducted with the camera and screen recordings (see **Chapter 3**, Section 3.6.2 The analysis of classroom observation data). The results in this section address the second research question focusing on the influence of collaborative CAPT of prosody on the amount and type of required support. The first part of this section presents the results generated from the camera recordings addressing the amount and type of required support under collaborative and individual access modes to the CAPT system. These results are compared to the thematic coding of student-student interaction in the collaborative CAPT group to assess the influence of collaboration on the amount and type of required support. These observation results are also supplemented by the screen capture data. Such results address the influence of collaborative and individual access modes to CAPT on the sentences practiced, repetition of sentences, and the skipping of sentences.

4.2.1 The amount of required support in collaborative and individual CAPT

The following table summarizes the type and amount of the guidance provided by the teacher to the Algerian EFL participants in the collaborative and individual CAPT groups during the camera recorded CAPT sessions.

Table 4.6 The total required support in collaborative and individual CAPT

		S2-Syllable stress	S3-Intonation	S4-Sentence stress	S5-General	Totals
CCAPTG	Technical support	4	4	6	3	17
	Non-technical support	3	6	5	4	18
	Total by sessions	**7**	**10**	**11**	**7**	**35**
ICAPTG	Technical support	11	8	12	1	32
	Non-technical support	13	11	14	9	47
	Total by sessions	**24**	**19**	**26**	**10**	**79**
	Totals	**31**	**29**	**37**	**17**	**114**

Note. S = session, General = general sentence pronunciation practice. # = instances of support. CCAPTG = Collaborative CAPT group, ICAPTG = Individual CAPT group.

As the Table 4.6 above indicates, the participants in the individual CAPT group required more support from the teacher, with a total of 79 support instances, than their counterparts in the collaborative CAPT group which required a total of 35 support instances from the teacher. More specifically, the participants in the individual CAPT group required a more amount of technical (32 support instances) and non-technical (47 support instances) support than the participants in the collaborative CAPT group who required technical support in 17 instances and non-technical support in 18 instances. Such a difference in the amount of the required support between the individual CAPT group and collaborative CAPT group was also consistent throughout all the recorded sessions. As presented in the "Total by sessions" section of Table 4.6, the participants in the individual CAPT group consistently required a higher total amount of technical and non-technical support from the teacher (24, 19, 26, 10) than their peers in the collaborative CAPT group (7, 10, 11, 7). The following section details the results of the two main types of support provided in the CAPT training sessions, namely, technical support and non-technical support.

4.2.2 The types of required support in collaborative and individual CAPT

4.2.2.1 Technical support

The technical support provided by the teacher during the CAPT sessions revolved mainly around two issues, 1) support for using the CAPT system, and 2) support for the functioning of the CAPT system. The use support was to assist participants to 1) brows or navigate the user interface of the CAPT system to access the activities and 2) to use advanced features of the program during practice (in activities). Functioning support, on the other hand, was to assist participants to overcome both, software and hardware issues. The software support included support to solve sound or graphics related issues; meanwhile, hardware support included support to solve display, headsets and other issues related to the functioning of the technology. The following table presents the recorded technical support instances provided by the teacher to the participants in the collaborative and individual CAPT groups.

Table 4.7 The amount of the technical support interventions by the teacher

		Collaborative CAPT group	**Individual CAPT group**
CAPT use support	Browsing activities	11	26
	Displaying feedback	1	1
CAPT software functioning support	Interface issues	1	0
	Sound issues	3	1
	Other software issues	0	1
CAPT hardware functioning support	Display issues	0	0
	Headset issues	1	1
	Other hardware issues	0	2
Total amount of technical support instances		**17**	**32**

As presented in the classroom observation Table 4.7 above, technical support was more dedicated to CAPT use issues rather than CAPT functioning issues in the two training groups. In the category of use support, the teacher mostly intervened to help participants navigate the user interface to access the specific activities for the practice of the three features. Such type of support was requested in a total of 26 instances in the individual CAPT group and a total of 11 instances in the collaborative CAPT group. Meanwhile, consulting feedback using the CAPT program seemed to receive equal, yet very little, support requests from participants in the two training groups with a total of one support instance in the two groups. Functioning support, on the other hand, was significantly less requested than use support with a total of six software functioning support involvements and four hardware functioning support involvements. Unlike use support, which was requested due to the lack of familiarity with the CAPT system, the functioning support was mostly the result of technical failures. During the recorded sessions, a total of ten software and hardware functioning support instances took place, five were delivered to each training group. The collaborative CAPT group mainly required support to overcome software technical issues, one was related to the interface of the program, three were related to audio during the training, and one hardware support to fix an issue related to a headset used by the participants. On the other hand, the functioning support interventions in the individual CAPT group were mainly delivered to overcome hardware issues. This included two support interventions for the purpose of charging the laptop, one issue related to the function of the headset, and one related to the audio during practice.

4.2.2.2 Non-technical support

Based on the thematic coding analysis of the camera recording of the training sessions, the non-technical support interventions were mainly related to 1) support with the setup of the training, 2) support with the tasks, and 3) support with feedback interpretation. A significant reason for the non-technical support interventions of the teacher during the CAPT sessions was the

management of practice. This mainly included giving the participants the signs for the start, continuation, and the completion of practice. The second most requested type of non-technical support was the support with tasks. This mainly included the clarification of instructions and further explanations for the objectives of the CAPT activities to the participants. Finally, the third type of non-technical support interventions revolved around the support with the interpretation of the automatic feedback generated by the CAPT system. The following table presents the recorded non-technical support instances provided by the teacher to participants in the collaborative and individual CAPT groups.

Table 4.8 The amount of the non-technical support interventions by the teacher

	Collaborative CAPT group	**Individual CAPT group**
Support with practice setup	13	35
Support with tasks	5	11
Support with feedback	0	1
Totals non-technical support	**18**	**47**

Overall, and in consistency with the technical support observations, Table 4.8 shows that the participants in the individual CAPT group required significantly higher non-technical support interventions from the teacher with a total of 47 recorded support instances. In comparison, the participants in the collaborative CAPT group required the non-technical support from the teacher in a total of 18 instances. This high frequency of the demand for teacher support was consistent throughout the three recorded non-technical support types. In support with the setup, which was the most requested non-technical support in the two training groups, the individual CAPT group required 35 support interventions; meanwhile, the participants in the collaborative CAPT group required teacher during 13 instances for the same reason. Similarly, clarifications from the teacher were requested during a total of 11 instances in the individual CAPT group, and five instances in the collaborative CAPT group. As for support with feedback interpretation, the participants in the individual CAPT group requested one support intervention; meanwhile, the collaborative CAPT group did not require such type of support during the training.

4.2.3 Student-student support interaction in the collaborative CAPT group

4.2.3.1 The amount and type of student-student support in the collaborative CAPT group

It was necessary to look at the amount and type of student-student (S-S) support interactions in the collaborative CAPT group to uncover the extent to which it influenced the demand of the teacher's support in this group. The following table, therefore, details the technical and non-technical S-S support interactions in the collaborative CAPT group throughout the four

analyzed sessions. The first part of the table presents the amount of the observed technical support instances between the participants in this group. The results in this section are presented in accordance with the teacher support coding plan (CAPT use support, CAPT functioning support) as no new type of technical support were detected between the participants. Meanwhile, the second section presents the non-technical support interactions including two types of support observed in the teacher support (support with setup and support with tasks) and added a section for emotional support which was observed between students. The following table presents the recorded student-student interactions that took place during the training.

Table 4.9 The amount and type of student-student collaborative interactions

		S2	S3	S4	S5	Totals
Technical S-S interactions	CAPT use support	0	9	4	8	21
	CAPT functioning support	0	0	0	0	0
	Total technical support interactions	**0**	**9**	**4**	**8**	**21**
Non-technical S-S interactions	Support with tasks	0	10	1	0	11
	Support with practice setup	1	4	5	1	11
	Emotional support	1	5	4	15	25
	Total non-technical support interactions	**2**	**19**	**10**	**16**	**47**
Total s-s interactions by sessions		**2**	**28**	**14**	**24**	**68**

Note. S = session, S-S = student-student.

According to the classroom observations presented in Table 4.9 above, a total of 68 student-student support interactions were recorded between the participants in the collaborative CAPT group. Similar to the teacher support results, S-S support interactions were more focused on non-technical issues with a total of 49 recorded instances than technical issues which constituted a total of 21 S-S support instances. The high frequency of non-technical interactions between students in the collaborative CAPT group was consistent throughout all of the analyzed sessions. The Non-technical interactions included two types of support that were observed in teacher-student support, namely, support with setup and support with tasks. Support with the setup between participants revolved mainly around the management of turn taking during practice. Such type of support was recorded in a total of 11 instances, most of which were recorded during the third session focusing on the practice of intonation (4 instances) and the fourth session focusing on the practice of sentence stress (5 instances). As for support with tasks, participants engaged in a total of 11 support instances to facilitate the understanding of the CAPT activities and their practice. This type of support was mostly observed during the third session dealing with intonation in a total of 11 instances. Additionally, a type of non-technical interactions that was only observed in the collaborative CAPT group was emotional interaction. This type of interaction revolved mainly around spontaneous interactions like

laughter or motivational support from participants to their peers during practice. Emotional interactions were recorded in a total of 25 instances and constituted the majority of non-technical interactions between the participants in the collaborative CAPT group. On the other hand, the technical S-S support interactions were recorded in a total of 21 instances and were all related to CAPT use rather than functional support. This was consistent during all of the recorded and analyzed sessions where participants intervened to provide use support for their peers whenever they were more familiar with a CAPT system's feature or option than their peers. Such instances of support, therefore, focused on navigating the program's UI, browsing and choosing activities. However, the participants in the collaborative CAPT group did not intervene to provide support for their peers whenever the technical issue emerged from a technical failure related to the hardware or the software of the learning program. This is particularly clear in the second section of technical function support in Table 4.9 where no support instances were recorded. In such instances, participants mainly relied on the teacher's support instead. While the superiority of non-technical interaction over technical interaction was consistent, the overall amount of S-S interaction fluctuated during the four sessions. As shown in the table above, the different sessions witnessed different amounts of technical and non-technical interaction between students. The second session dealing with sentence stress witnessed the least amount of S-S interaction as it recorded a total of two interactions, all of which were non-technical in their nature. On the other hand, the third session dealing with sentence intonation witnessed the highest amount of S-S interaction with a total of 28 interactions, 19 of which were non-technical and the other nine were technical. After that, the following two sessions witnessed a slight drop in overall S-S interactions; nevertheless, the non-technical interaction was maintained as the predominant reason for interaction between the students in this group.

4.2.3.2 The influence of collaboration on the amount of required support

Since collaboration between EFL students during practice with the CAPT technology is the treatment being studied, it was important to see how it compared with the support provided by the teacher to this group. This section, as illustrated in the following figure, compares the amount and type of teacher's support to participants in the collaborative CAPT group with the amount and type of S-S interactions. The reason for undertaking such comparison with the results is to investigate the extent to which the amount and type of S-S support interactions in the collaborative CAPT group has influenced the amount and type of support needed from the teacher during the training.

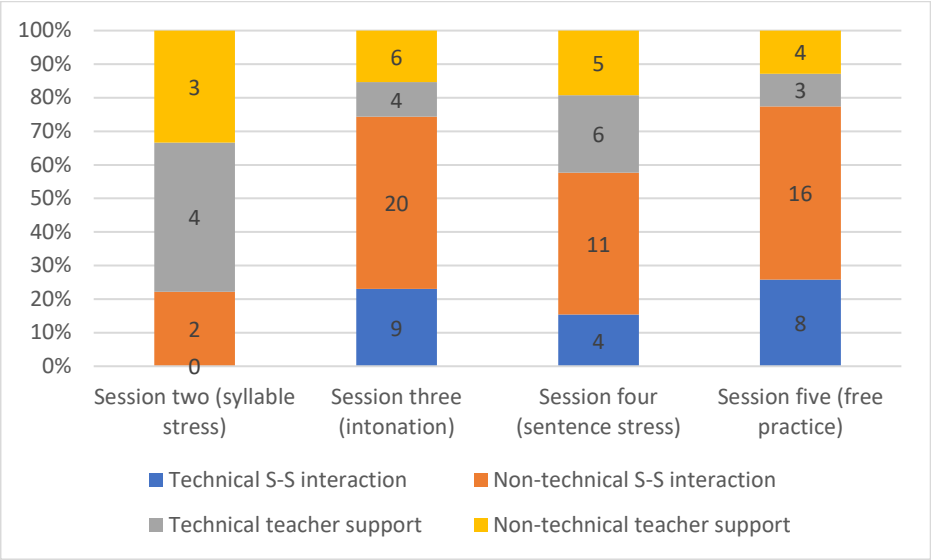


Figure 4.6 Teacher support interventions versus student-student support interactions

Overall, the amount of S-S support interactions in the collaborative CAPT group has significantly exceeded the amount of support involvements needed from the teacher throughout the course. This is especially clear when reflecting at the results presented in Table 4.6 where the total of teacher support involvements with this group has reached a total of 35 support instances, while S-S support interactions were recorded a total of 68 times (Table 4.9). This predominance of S-S support interactions over the need for teacher's support, however, was not consistent throughout all of the sessions. Interestingly, the second session focusing on sentence stress during CAPT practice witnessed a higher need for technical and non-technical support from the teacher as opposed to engaging in S-S support interactions. During this session, EFL students in the collaborative CAPT group needed a total of seven teacher technical and non-technical support involvements, while only two non-technical S-S support interactions were recorded in this session.

After the second session, a significant increase in S-S support interactions was noticed in sessions three, four, and five focusing on intonation, sentence stress, and general prosody practice respectively. This interaction was mainly dealing with non-technical issues related to the CAPT tasks, turn taking, and emotional interactions. In their technical support interactions, participants in the collaborative CAPT group only delivered use support based on their familiarity with the program; meanwhile, there were no recorded instances of support from students that addressed technical issues related to the software or hardware of the CAPT system. On the other hand, the technical support interventions from the teacher covered both, support with using the CAPT system and its function (hardware and software). However, support instances from the teacher witnessed less spontaneously as evidenced by the lack of emotional

interactions, which were recorded in a total of 25 instances between the participants in the collaborative CAPT group.

4.2.4 Screen capture results

This section of the results chapter presents the data generated the screen recording application Microsoft Encoder 4 which kept track for participants use of the CAPT system from the screen perspective. And while such complimentary data collection tool helped in detecting the type of support participants needed from the teacher and peers, it also helped in generating results that tracked the number of sentences practiced in each group, the number of sentences repeated, and the number of skipped sentences. Such results, and while they were not directly addressed in the second research question, do shed light on the extent to which participants in each training group faced challenges during the training and therefore requested support. The following table summarizes the results generated from the screen capture application and compares the two training groups.

Table 4.10 Screen capture results

	Collaborative CAPT group				**Individual CAPT group**			
Sessions	N	Rep	Avg	Skip	N	Rep	Avg	Skip
S2	33	53	1.60	9	163	252	1.54	9
S3	61	170	2.78	10	201	298	1.48	7
S4	86	158	1.83	36	168	256	1.52	1
S5	39	50	1.28	1	59	81	1.37	10
Means	**54.8**	**107.8**	**1.9**	**14**	**144.5**	**221.8**	**1.5**	**6.8**
Totals	**219**	**431**	**/**	**56**	**591**	**887**	**/**	**27**

Note. S = session, N = number of practiced sentences, Rep = number of repeated sentences, Avg = average repetition, Skip = number of skipped sentences.

As shown in the table above, EFL students practicing in the individual CAPT group seemed to have benefited from a higher amount of training than their counterparts in the collaborative CAPT group. This is especially clear when looking at the number of sentences practiced during the course in each group. The four sessions of the course recorded a total of 810 sentences, 591 of which were practiced by the participants in the individual CAPT group, whereas a total of 219 sentences were practiced by the participants in the collaborative CAPT group. This advantage for the individual CAPT group was consistent throughout all the sessions as this group recorded a higher number of practiced sentences when compared to the collaborative CAPT group in all of the sessions. In addition to that, similar to the results generated from observing teacher guidance and S-S interaction, the number of sentences practiced by students using the CAPT technology varied from one session to the other. Overall, sessions three and

four recorded a significantly higher number of sentences (196 sentences, 98 sentences in both groups respectively) than sessions two and five (262 sentences, 254 sentences in both groups respectively). In the collaborative CAPT group, the fourth session dealing with sentence stress recorded the highest number of practiced sentences, whereas in the individual CAPT group the highest number of practiced sentences was recorded in the third session dealing with intonation. As for the sessions that marked the least number of practiced sentences, the collaborative CAPT group recorded this figure in the second session with total of 33 sentences, meanwhile the individual CAPT group recorded this in the fifth session with a total of 59 sentences. It was clear that the sessions dealing with intonation and sentence stress marked a significant number of practiced sentences compared to the syllable stress and general practice sessions.

The lead of the individual CAPT group over the collaborative CAPT group in terms of the number of practiced sentences with CAPT technology was not only exclusive the number of practiced sentences. The same pattern was noticed in the overall repetition of sentences. EFL students in the individual CAPT group (a total of 887 repetitions) repeated sentences twice as much as their counterparts in the collaborative CAPT group (total of 431 repetitions). Such statistics were, however, contradictory when looking at the average repetition of a single sentence. While EFL students in the individual CAPT group repeated sentences more frequently, their counterparts in the collaborative CAPT group seemed to have a higher repetition average of single sentences. This was the case in the first three recorded sessions in this study (S2, S3 and S4) and is especially clear when looking at the overall average of repeating single sentences with an average of 1.87 for the collaborative CAPT group and an average of 1.48 for the individual CAPT group.

Similar results, in relation to the amount of practice with the CAPT program, were also noticed when looking at the number of skipped sentences by participants in groups. Interestingly, EFL students in the collaborative CAPT group, although training in pairs, had a higher tendency to skip sentences than EFL students in the individual CAPT group. Overall, the collaborative CAPT group recorded a total of 56 skipped sentences during the course, i.e. an average of 14 sentences per-session, whereas the individual CAPT group recorded a total of 27 skipped sentences during the course, i.e. an average of 6.75 sentences per-session. The number of skipped sentences, however, was not consistent during all of the sessions. These numbers diverged between one session to the other. For example, while the second and third sessions witnessed similar numbers of skipped sentences, the remaining fourth and fifth sessions witnessed significant differences. The reason and interpretation behind such results are presented in the discussion chapter.

4.3 Participants' Perceptions toward CAPT

This third section of the results chapter presents the findings that were generated by learning logs and interviews. The results in this section address participants' perceptions towards CAPT of prosody in relation to their mode of access to the technology (i.e. collaborative or individual). This section is divided into three main parts. The first part presents the results of participants' perceptions towards the ease of using the CAPT system (PEU) for prosody practice, while the second part details the results of participants' perceptions toward the usefulness of the CAPT system (PU) for prosody practice. Both of these sections highlight the patterns and differences between the perceptions of the collaborative CAPT group and the individual CAPT group based on the type (positive or negative) and frequency of the perceptual statements provided in the learning logs and interviews. Finally, the third part presents six detailed individual case descriptions for the perceptions of the participants with whom post-study interviews were conducted (three from the collaborative CAPT group, and three from the individual CAPT group).

4.3.1 Participants' perceived ease of use of CAPT

The learning log and interview reports touched on the four PEU themes determined in the thematic coding scheme adopted in the current study to analyze participants' perceptions towards CAPT of prosody under collaborative and individual access modes. The reports included positive PEU reports about the CAPT system's overall use and UI navigation, audio-visual input, activities, and feedback. On the other hand, participants' negative PEU reports touched on the CAPT system's UI, activities, and feedback. Perceptions about program navigation addressed the extent to which participants found the CAPT system's UI easy to understand and navigate on their own. Perceptions about the CAPT system's audio-visual input revolved around participants' perceived ease of understanding the speech models presented in the training program. Perceptions about the CAPT system's activities revolved around the complexity of practicing with the activities in the CAPT system. Finally, the fourth theme revolved around the CAPT system's audio-visual feedback and its ease of interpretation. The following table presents the positive and negative PEU reports with examples from the learning logs and interviews of participants from the collaborative and individual CAPT groups.

Table 4.11 Participants' perceived ease of use of CAPT

		Collaborative CAPT group		Individual CAPT group	
	CAPT aspect	**Perception (frequency)**	**Excerpts from interviews & learning logs**	**Perception (frequency)**	**Excerpts from interviews & learning logs**
Positive PEU perceptions	**System UI**	Navigating the program's UI was easy (2/6 - 33.33%)	1) Selma: "At first using the program was not easy, but with time I learned how to use it and became used to it." (Interview) 2) Wafa: "the program was helpful and I'm going to keep using it" (Interview)	Navigating the program's UI was easy (1/6 - 16.66%)	1) Okba: "I believe I can use the CAPT program in both situations (at home or in the classroom), but generally I prefer to use it alone at home. Even in the classroom, I don't think I have a problem …" (Interview)
	Input	Audio-visual input was easy to understand (2/6 - 33.33%)	1) Wafa: "it gave me the change to practice comprehensible listening to native speakers and pronunciation at the same time. It was a new experience for me" (Interview) 2) Ikram: "Generally, the type of activities where we practice, receive immediate and pass to the next level based on that feedback" (Interview)	Audio-visual input was easy to understand (2/6 - 33.33%)	1) Okba: "in the activities the program was easy to use, and I didn't find a problem" (Interview) 2) Mourad: "They (the recordings) helped me work on my pronunciation based on native speakers (models), this also made it feel like I am interacting with another person" (Interview)
	Activities	Activities were easy and enjoyable (3/6 - 50.00%)	1) Ikram: "I liked the activity of listening and repeating and the fact that the CAPT technology was correcting my pronunciation mistakes" (Interview) 2) Selma: "Generally, the type of activities (that I found helpful) where we practice, receive feedback and pass to the next level based on that feedback" (Interview) 3) Sarah: "we had fun (with the) activities and we enjoyed practicing them"	Activities were easy and enjoyable (2/6 - 33.33%)	1) Mourad: "in the activities, the program was easy to use, and I didn't find a problem" (Learning log & Interview) 2) Okba: "The second most helpful aspect of the technology was the activities, especially those that gave you the chance to create a conversation. They were very helpful for me personally." (Interview)
	Feedback	The feedback was easy to understand 3/6 - 50.00%)	1) Ikram: "Yes (it was easy to understand), it (feedback) was showing me if I pronounced a word or sentence in the right way or the wrong way and how to correct my pronunciation" (Interview) 2) Selma: "the feedback was clear and easy to understand" (Interview)	The feedback was easy to understand (3/6 - 50.00%)	1) Okba: "I think the feedback was simple and easy to understand. The visual representation was clear and intuitive" (Interview) 2) Mourad: "think it is obvious and intuitive. It shows the pitch and frequency

			3) Wafa: “It (feedback) was simple, yes I was able to understand it.” (Interview)		of your speech. The red highlighting of words means that you didn’t pronounce a word correctly. After all, you need to repeat and enhance your pronunciation” (Interview) 3) Issam: “I think the feedback was the most helpful aspect of the program … At the beginning I didn’t understand it. But with time I started to get it” (Interview)
Negative PEU perceptions	**System UI**	Navigating the program’s UI was challenging at the start of the course (1/6 - 16.66%)	1) Selma: “At first using the program was not easy, but with time I learned how to use and became used to it.” (Interview)	Navigating the program’s UI was challenging at the start of the course (1/6 - 16.66%)	1) Mourad: “at first, I had an issue with the program. It was kinda difficult to browse the software, chose and use the activities in the program. The UI of the program was kind of unclear for me. But, in the activities the program was easy to use, and I didn’t find a problem.” (Interview)
	Input	/	/	/	/
	Activities	Speech recognition failures (3/6 - 50.00%)	1) Wafa: “I found the program hard because it didn’t hear my voice clearly and it kept interrupting me and forcing me to use its accent. That’s why I found it hard … I guess. Also, I think my voice was low and sometimes it was so high that the program didn’t hear clearly. Yeah, there were technical issues” (Interview) 2) Ikram: “Sometimes … you have to repeat the sentence many times so that the program gets it.” (Interview)	Speech recognition failures (3/6 - 50.00%)	1) Mourad: “Yeah, the program didn’t hear me sometimes. It was obvious that there were many technical issues.” (Interview) 2) Issam: “I had to repeat manytimes to make it exactly like the model. I think that was challenging for me.” (Interview) 3) Okba: “I would say the feedback was fair with a percentage of 70%. Because, it is still a program.” (Interview)

			3) Selma: “the program sometime doesn’t hear me well, so I had to repeat what I am saying several times.” (Interview)		
		/	/	The practice was repetitive (2/6 - 33.33%)	1) Okba: “I still think the activities were repetitive, except for the activities where the technology pushed to create a conversation” (Interview) 2) Mourad: “listening and repeating with just the program is not that helpful. We need to use the practice in a more contextual activity.” (Interview)
	Feedback	Scoring the output was confusing and not reflective of performance (1/6 – 16.66%)	1) Wafa: “Actually, the score was confusing me. I was too focused with the soundwaves and how to use intonation or stress, but the score was not responding that I forgot the goal.” (Interview)	/	/

Note. To keep the excerpts short, the parentheses “()” are used to identify and explicitly point out the CAPT aspect or topic being discussed in that section of the learning log or interview.

Overall, participants' PEU reports in both groups, collaborative and individual, addressed similar points when discussing the use of the CAPT system to practice prosody features. In their positive reports, both groups agreed that the program's UI was generally easy, the activities were simple to practice, and the visual feedback was intuitive and interpretable. Similarly, the two training groups provided comparable negative reports about a challenging start with the program's UI and the disruption caused by the speech recognition failures to the practice process. However, the main difference between participants' PEU reports was noticed in their perceptions of the practice nature in CAPT. While participants in the collaborative CAPT group reported finding the practice with activities engaging and enjoyable, their peers in the individual CAPT group perceived it to be monotonous and repetitive. The following three subsections present participants' positive and negative PEU reports in more detail.

4.3.1.1 Participants' perceived ease of program UI navigation

In terms of using the CAPT system's UI, participants in the two training groups found it generally easy to use. This was mainly because the most important options of starting the program, choosing activities, and using its features were generally perceived to be accessible to most participants. Such UI features in the used CAPT system (Tell Me More), as reported by Wafa from the collaborative CAPT group and Okba from the individual CAPT group, were well designed and did not recommend a lot of technical knowledge to access them. When discussing the CAPT system's UI in the post-study interview, Wafa said that the program's UI was helpful and that she plans to keep using it in the future (Interview). Okba, on the other hand, found the CAPT system's UI simple to learn and use both at home or in the classroom. For such simplicity in the UI, all of the interviewed participants in the two training groups reported that, if possible, they would use the same (or similar) learning program by the end of the training.

Such positive perceptions, however, do not leave out the fact that many participants of both groups reported facing some issues by the start of the training that emerged from the CAPT system's UI. Such reports were particularly raised in the learning logs of the session focusing on stress. According to the reports of Selma from the collaborative CAPT group and Mourad from the individual CAPT group, there was a confusion about selecting the activities and accessing features like replaying the audio speech models and rerecording pronunciation output. During the interviews, these two participants clarified that such issues emerged mainly from their lack of familiarity with the program's UI and that they overcame such minor difficulties through practice and support from the teacher and peers. In this regard, Selma said: "at first, using the program was not easy, but with time I learned how to use it and became used to it" (Interview). Similarly, Mourad reported: "at first, I had issues with the program. It was kinda difficult to brows the

software…the program was kind of unclear for me. But, in the activities the program was easy to use, and I didn't find a problem." (Interview).

4.3.1.2 Participants' perceived ease of understanding the audio-visual input in CAPT

Participants' reports about the perceived ease of understanding input were generally positive regardless of the access mode to the CAPT system. In their learning logs and interviews, participants reported that they were generally comfortable with the language level of the audio samples recorded by native speakers. In her interview, Wafa from the collaborative CAPT group reported that she found the native speaker samples easy to understand and that she rarely had to listen again to a sample because of language difficulties. Similarly, Okba and Mourad from the individual CAPT group reported finding the speech models in activities easy to understand. Such positive PEU reports also pointed out that the input was presented in ways that facilities its understanding. In addition to the audio sample recording, the CAPT system presented its transcription, its soundwaves and pitch contour representation, and occasional visual aids like pictures and videos. All of these elements, according to participants, contributed positively to understanding the input.

4.3.1.3 Participants' perceived ease of practice in CAPT activities

The main difference in the participants' perceptions in the two training groups was detected when participants addressed the PEU of CAPT activities. On the one hand, participants of the two training groups found the form of CAPT activities similarly easy to understand and practice with similar negative PEU reports on the speech recognition failures. On the other hand, they differed when addressing the way in which they practiced. While the participants of the collaborative CAPT group reported enjoying the innovative way of pronunciation practice, the participants in the individual CAPT group often reported that the practice was repetitive. Such PEU reports about the CAPT system's activities are detailed in the following paragraphs starting with perception similarities and then moving to the differences between the results of the two groups.

Overall, participants in the two training groups reported that they found the CAPT activities used in the current study (i.e. "listen & repeat" and "listen & choose the correct answer") simple and easy to practice. This simplicity, according to Selma and Ikram from the collaborative CAPT group and Mourad from the individual CAPT group, was particularly true for the "listen & repeat" activities as they only required listening to the speech models and repeating them. When discussing this issue in the interviews, Selma said that she generally found the "listen & repeat" activities

simple and helpful as they only required producing the sentences and receiving immediate feedback. As for Mourad, he reported that "in the activities the program was easy to use" and that he "didn't find a problem" (Interview). This, according to the PEU reports in the two groups allowed the participants to focus on their pronunciation of the prosody features, which is their main goal in the training sessions, instead of thinking about a correct answer as in the "listen & choose the correct answer". Some participants like Okba from the individual CAPT group, however, reported that the "listen & repeat" activities were too simple. In the post-study interview conducted with him, he explained that he especially liked the additional challenge in the "listen & choose the correct answer" because they simulate real-life conversations.

This perceived ease of using activities was, however, disturbed by the speech recognition failures in the CAPT system. According to negative PEU reports of participants on the CAPT system's activities, the technology often failed to detect their pronunciation output appropriately. For this reason, they reported that they were obliged to repeat the pronunciation of some sentences multiple times until the program could detect them. In this regard, Ikram from the collaborative CAPT group reported: "you have to repeat the sentence many times so that the program gets it" (Interview). To avoid such ASR failures, Issam from the individual CAPT group said that he often found himself trying to imitate the native model's pronunciation (Interview). The speech recognition failures made the simple pronunciation practice (particularly in "listen & repeat" activities) unnecessarily more challenging and therefore influenced participants' PEU negatively.

The more participants progressed in their training, the differences started to appear in the way each training group (individual vs collaborative) perceived the ease of practicing prosody with the CAPT system. On the one hand, participants in the collaborative CAPT group repeatedly emphasized the innovative and engaging nature of activities in their reports. During their interviews, the participants in the collaborative CAPT group explained that CAPT presented a new and different approach to practicing pronunciation for them. For example, in her interview, Sarah pointed out that she (and her peers) had fun with the activities and enjoyed practicing them (Interview). For Ikram in the same group, the practice was particularly interesting given the innovative features presented by the system. According to their reports, this practice setup, with access to audio-visual input, speech recognition, and feedback, increased their motivation to use the technology and practice with it. This kept them interested in the training and maintained their high motivation throughout the sessions.

On the other hand, participants from the individual CAPT group, and while they also found CAPT activities innovative, they reported multiple times that they found them repetitive. Such emerging theme from the reports of these participants was especially addressed during the interviews and particularly focused on the "listen & repeat" activities. Mourad, for example, noted, while the activities provided an innovative way to practice sentence pronunciation, at some point listening and repeating became too monotonous (Interview). This did not help him to keep the same level of motivation to practice as sessions progressed. Similarly, Okba from the same group pointed out the repetitiveness of activities, but with only the listening and repeating activity. According to him, the "listen & choose the correct answer" activities were less repetitive because they were more similar to a conversation than the "listen and repeat" activities.

4.3.1.4 Participants' perceived ease of feedback interpretation

Overall, participants in the two training groups reported that feedback was generally easy to understand and interpret. Participants in the two groups reported that the various audio speech samples and speech visualization features like soundwaves, the pitch contour, and error detection offered by the program gave a clear image on their pronunciation performance during the practice. Such positive PEU perceptions on the ease of interpreting were first reported in learning logs and were then elaborated on in the interviews. For example, Wafa and Selma from the collaborative CAPT group, reported that the CAPT system's feedback was simple and that they were able to understand it. In the same vein, Mourad and Okba from individual CAPT group reported that the feedback was clear and intuitive as it represented the prosody features in a logical way.

The only exception in the positive PEU perceptions on feedback came from some participants in the collaborative CAPT group and addressed the automatic scores generated by the CAPT system. Automatic scores were the only element of feedback that was perceived negatively in terms of its ease of interpretation. According to Wafa, such aspect of the CAPT program's feedback was confusing. When interviewed, Wafa said: "actually, the score was confusing me. I was too focused with the soundwaves and how to use intonation or stress, but the score was not responding that I forgot the goal." (Interview). According to her statement in the interview, scores assessed her pronunciation output only with numbers that did not explicitly highlight the pronunciation error. This made the interpretation of feedback in some sentences a little difficult for students practicing collaboratively.

4.3.2 Participants' perceived usefulness of CAPT

In their learning log and interview reports, participants in the collaborative and individual CAPT groups addressed the usefulness of the three main aspects of CAPT, namely the audio-visual input, the activities and practice, and the audio-visual feedback, as predicted in the thematic coding scheme (see **Chapter 3**, Figure 3.3**)**. Participants mostly referred to input in their learning logs where they focused on how it illustrated the process of each prosody feature and its role in English pronunciation. Moreover, participants talked about the extent to which the CAPT system's activities helped them practice the prosody features and work on their pronunciation problems. In their reports about feedback, participants discussed its most useful elements and the extent to which they were helpful in detecting their pronunciation problems. The following table presents participants' PU of collaborative and individual CAPT of prosody based on their reports in learning logs and interviews.

Table 4.12 Participants' perceived usefulness of CAPT

		Collaborative CAPT group		Individual CAPT group	
	CAPT aspect	**Perception (frequency)**	**Excerpts from interviews & learning logs**	**Perception (frequency)**	**Excerpts from interviews & learning logs**
Positive PU perceptions	**Input**	Audio-visual illustration of prosody features and their use (6/6 - 100%)	1) Maria: "I like the way it shows us the place of the stress" (Learning log) 2) Sarah: "the program helped in showing how to pronounce sentence stress correctly" (Learning log) 3) Selma: "the program helped in showing how to pronounce stress words" (Learning log) 4) Wafa: "when I started this brief computer assisted pronunciation training course, I really understood more about sentence pronunciation like intonation, stress and the use of high and low pitch very well" (Interview) 5) Ikram: "It was helpful in understanding the sentence pronunciation features" (Interview) 6) Rym: "Position of the stress in the sentence helps us know where we should put emphasis" (Learning log)	Audio-visual illustration of prosody features and their use (5/6 - 83.33%)	**1)** Okba: "It helped me to concentrate on the key words in each sentence" (Learning log) **2)** Issam: "the program shows the high pitch and low pitch, & stressing specific words" (Learning log) **3)** Riyadh: "I have learned many new words and how to pronounce them in a sentence" (Learning log) **4)** Esa: "it (the learning program) shows where to put the stress" (Learning log) **5)** Mourad: "The brief course was helpful to understand sentence pronunciation and practice at the same time" (Interview)
	Activities	The opportunity to practice prosody features (5/6 - 83.33%)	1) Wafa: "I found listening and then choosing the right answer the most helpful activity in the program because, it gave me the chance to listen to native speakers and practice pronunciation at the same time. It was a new experience for me" (Interview) 2) Ikram: "I liked the activity of listening and repeating and the fact that the	The opportunity to practice prosody features (3/6 - 50.00%)	1) Mourad: "I really liked it because we studied phonetics only for two years and it was mostly theoretical while this training with the application was practical" (Interview) "It made it (practice) easier and quicker" (Learning log) 2) Okba: "The second most helpful aspect of the technology was the activities, especially those that gave you the chance to

			program was correcting my pronunciation mistakes" (Interview) 3) Selma: "The conversation activity in the sentence rhythm session was helpful as it helped us to focus on the meaning and the way of pronunciation when we speak" (Interview) 4) Rym: "It is helpful for enhancing speaking and listening skills. For me it is very essential" (Learning log) 5) Maria: "I learned about sentence rhythm and stress by hearing and repeating sentences" (Learning log)		create a conversation. They were very helpful for me personally" (Interview) 3) Issam: "There was always a variety of training activities in the program and I liked that it was focusing each time on some aspect of pronunciation like intonation or stress. For example, when expressing shocking the program will make you pay attention to intonation and how to use it" (Interview)
	Feedback	Accurate highlighting and correction of pronunciation mistakes (5/6 - 83.33%)	1) Ikram: "The feedback element that I found most helpful was the visual red highlighting of pronunciation errors. It was helpful for me" (Interview) 2) Wafa: "The feedback … when I receive a comment and correction to my pronunciation, it really helped me. It also showed me that I was not very good at using the British accent and some prosody features like intonation" (Interview) 3) Selma: "It (feedback) was useful … it was indicating how well I am pronouncing a sentence." (Interview) 4) Rym: "the computer program teach and correct the intonation mistakes because sometimes we don't focus on intonation.	Accurate highlighting and correction of pronunciation mistakes (5/6 - 83.33%)	1) Esa: "It (feedback) shows the mistake exactly" (Learning log) 2) Okba: "The computer gave a helpful feedback about the rhythm of sentences and its use" (Learning log) 3) Marwa: "I found it (feedback) beneficial. It is detailed and can improve your reading and listening skills" (Learning log) 4) Issam: "I think the feedback was the most helpful aspect of the program. Because it was fast and immediate after my speech. Particularly … the red highlighting of words and soundwaves" (Interview) 5) Mourad: "The different types of feedback helped in different ways and were beneficial. For example, the sound waves focus on stress and intonation" (Interview)

			It also shows the situation of the speaker (context of pronunciation)" (Learning log) 5) Sarah: "it (feedback) showed me how to emphasize content words in a sentence … and avoid mistakes" (Learning log)		
Negative PU perceptions	**Input**	/	/	/	/
	Activities	/	/	/	/
	Feedback	Incomprehensible scores for output (3/6 – 50.00%)	1) Selma: "I actually didn't notice and care too much about the green bar. I was too much focused on the sound waves and the highlighting of pronunciation errors" (Interview) 2) Wafa: "Actually, the score was confusing me. I was too focused with the soundwaves and how to use intonation or stress and rhythm, but the score was not responding that I forgot the goal … I was stressed as I wanted to be the best" (Interview) 3) Ikram: "you have to repeat the sentence many times so that the program gets it" (Interview)	Incomprehensible scores for output (1/6 – 16.66%)	Issam**:** "I didn't care too much about it (scores), every time I was talking it was green" (Interview)

Note. To keep the excerpts short, the parentheses "()" are used to identify and explicitly point out the CAPT aspect or topic being discussed in that section of the learning log or interview.

Overall, participants' positive PU predominated their reports about the usefulness of CAPT. Participants particularly expressed positive views about the important role of the audio-visual input provided by the CAPT system. In terms of the practice with the CAPT system's activities, the two training groups provided positive reports in which they appreciated such opportunity to practice their pronunciation and participants in the individual CAPT group particularly appreciated the self-paced of nature of such practice. Moreover, reports on the usefulness of feedback were generally similar between the two training groups. Both groups positively perceived the different audio-visual tools in helping them to detect their mistakes and both groups found that scores played the least useful role in evaluating their pronunciation. The following three sections present participants' reports about the usefulness of the CAPT systems' input, activities, and feedback in more detail.

4.3.2.1 Participants' perceived usefulness of the CAPT system's audio-visual input

Almost all of the participants from the two training groups reported finding the audio-visual input provided by the program useful for their practice of the prosody features. Such positive PU perceptions were mostly explicitly reported in learning logs and particularly emphasized on the way in which input was contributing to their understanding of the prosody features and their roles in English pronunciation. In this regard, there was a clear emphasis on the role of the audio speech samples and their representation through soundwaves and pitch contours which helped in visualizing the features. Wafa from the collaborative CAPT group, stated explicitly in her learning logs that the speech models and their visual representation helped her in having a better knowledge about syllable stress, intonation, and sentence stress. According to her, the audio samples were not only examples to be imitated but also were there to highlight the influence of each of the prosody features on meaning. In terms of the perceived useful effects, the reports of most participants focus on input's usefulness in highlighting stress. This was particularly apparent from the learning log reports (see **Table 4.12** above) of Maria, Sarah, Selma, and Rym who found the soundwaves helpful in locating the place and amount of syllable and word stress within the models.

Similar perceptions were also reported by participants of the individual CAPT group about the usefulness of the audio-visual input provided by the system in understanding prosody features. In his interview, Mourad reported that the brief course helped him understand the different sentence pronunciation features and practice them at the same time (Interview). Like their counterparts in the collaborative CAPT group, participants in individual CAPT group reports predominantly focused on the usefulness of the audio-visual input in illustrating stress placement. This was particularly clear from the learning log reports of Okba, Issam, Riyadh, and Esa who found the highlighting of the key syllables and words very valuable in to their practice of sentences. Some participants in this

group, like Issaam, also provided positive reports about the useful role of the visual speech representations in highlighting the intonation direction of words and statements.

Moreover, participants in both groups also reported an appreciation for the additional sounds, pictures, and videos that were sometimes accompanied by the speech audio samples. These features added a context and meaning to the samples and facilitated their understanding. In other words, the pronunciation of different types of sentences (declarative, exclamatory, interrogative, or expressive) was not presented always in isolation. Such emerging positive PU theme about the CAPT system's input was equally touched in the reports of the participants in both groups throughout the training. It was, however, particularly emphasized in the training session focusing on sentence intonation. For example, in her learning log, Rym from the collaborative CAPT group stated that the audio-visual features which accompanied the pronunciation of sentences helped in understanding the context in which sentences were pronounced and therefore justified the use of intonation.

Similarly, in the interview of Issam from the individual CAPT group, he reported the that the input in the CAPT system was presented with a highlight to its context. For this, Issam said: "I liked that it (the CAPT system) was focusing each time on some aspect of pronunciation like intonation or stress. For example, when expressing shocking, the program will make you pay attention to intonation and how to use it." (Issam, Interview). This, according to him, helped in differentiating between the different uses of intonation in an interrogative statement asking a question or in an expressive statement expressing shock. According to one of Riyadh's learning log reports, audio-visual input was particularly useful as it did not only highlight the pronunciation of words in isolation but showed their pronunciation within different types of statements and this made the practice (perceptual and productive) more meaningful. Such audio-visual features of the CAPT system, according to the participants of both training groups, contributed to a better understanding of the influence of prosody features on the meaning being addressed.

It is worth noting that the analysis process did not detect the emergence of negative PU themes about the audio-visual input provided by the CAPT system.

4.3.2.2 Participants' perceived usefulness of the CAPT system's activities

Overall, despite the acknowledged speech recognition limitations in students' PEU reports, the opportunity to practice prosody features through sentence pronunciation activities in CAPT was positively perceived in terms of its usefulness by participants of both training groups. Almost all of

the participants agreed that the CAPT activities gave them a valuable opportunity to practice their sentence pronunciation and prosody features for an extended and personalized period of time. This positive PU point was especially highlighted by participants given the limitations of pronunciation instruction in the Algerian EFL classroom which, according to Wafa from the collaborative CAPT group, provide limited pronunciation practice opportunities. Similarly, Mourad from the individual CAPT group perceived the CAPT activities as very useful because they offered a variety of practical opportunities to practice prosody. This is unlike the predominantly phonemic approach that participants are exposed in their traditional course which provides pronunciation practice mostly through phonetic transcription activities without engaging them in actual practice.

With regards to the types of activities, participants in the two training groups found the two types (i.e. "listen & repeat" and "listen & choose the correct answer") useful in different ways. Overall, most participants' reports about the PU of activities mentioned the "listen & repeat" activity. Such type of CAPT activities was especially positively perceived by Ikram, Rym, and Maria from the collaborative CAPT group and Mourad from the individual CAPT group. According to the participants of the collaborative CAPT group, the "listen & repeat" activities were very useful to learn about stress and intonation through listening and repeating the sentences. As for Mourad, he attributed the usefulness of the "listen & repeat" activities to their "quick and easy" approach to learning and practicing prosody features. Other participants like Sarah and Wafa from the collaborative CAPT group and Okba from the individual CAPT groups emphasized more on the usefulness of the "listen & choose the correct answer" activities in their reports. According to the participants of the collaborative CAPT group, such type of activities presented an engaging and innovative way to practice pronunciation. Similarly, Okba from the individual CAPT group found the "listen & choose the correct answer" activities more engaging than the "listen & repeat" activities because they gave an opportunity to practice prosody in a simulated conversation rather than repeating sentences.

Participants of the two training groups also emphasized on the usefulness of the self-paced practice features of CAPT. When asked about their preferred context of using the CAPT system (home vs classroom), participants of the two groups reported that they prefer practicing at home and on their own pace. When interviewed, Ikram, Selma, and Wafa from the collaborative CAPT group pointed reported that they would like to practice using a CAPT technology at home if they had the choice. When asked about the reason for choosing home in her interview, Wafa explained that she wouldn't be stressed and will work on her listening and pronunciation problems on her own pace.

Even participants who were engaged in the individual CAPT groups mostly preferred practicing alone for the same reasons as their counterparts. In this regard, Okba said the following in his interview: “I believe I can use it (the technology) in both situations, but generally I prefer to use it alone at home. Even in the classroom, I don’t think I have a problem, but my preference is home” (Interview).

4.3.2.3 Participants’ perceived usefulness of the CAPT system’s feedback

Participants’ reports about the usefulness of the CAPT feedback were mostly similar when tackling both positive and negative elements of feedback. The two training groups perceived the speech visualization features and the audio speech samples to be very useful as they helped them in detecting their pronunciation problems. The positive PU perceptions about these elements of feedback were equally reported in learning logs and interviews. In their learning logs, participants reported that they relied heavily on the audio-visual feedback in evaluating their use of the prosody features. This reliance on feedback was particularly emphasized in the learning logs of the session focusing on intonation. In this session, participants provided positive reports about the complementary role that the blue pitch contour in “Tell Me More” played along with the audio samples in helping them notice the direction of intonation in their speech.

During the post study interviews, when participants were asked about the most useful aspect of the CAPT systems, almost all of the participants in the two training groups mentioned feedback. According to a common theme emerging from the answers of the interviewed participants, the most useful function of the automatic feedback in CAPT was allowing them to track their pronunciation progress. This was explicitly reported by Okba from the individual CAPT group who stated the following: “The aspect of CAPT technology that I found most helpful was the feedback that was generated by the program. It gives an image of your speech and plenty of chances to correct yourself” (Interview). Mourad and Issam from the same group particularly appreciated the immediate nature of feedback as it quickly evaluated their pronunciation output after producing the sentences. Similarly, participants of the collaborative CAPT group found feedback to be very useful in monitoring their pronunciation performance throughout the training sessions. In their interviews, Wafa and Selma from this group appreciated the role of CAPT feedback in “indicating how well” they were pronouncing the sentences (Interview).

This ability to monitor progress, according to the participants, was comprehensible as it was delivered with different tools, such as: audio speech samples, soundwaves, and pitch contours.

However, visual error detection (highlighting of errors) was reported by most participants in the two training groups to be the most useful feature of the CAPT feedback. Positive PU reports about error detection and correction were found in the learning logs and interview transcripts of Wafa, Ikram, Rym, and Sarah from the collaborative CAPT group and Esa, Marwa, and Issam from the individual CAPT group (See **Table 4.12** above). According to participants, error correction, and while it was sometimes inaccurate due to speech recognition failures, often helped in raising their awareness of their prosodic pronunciation problems.

One element of feedback that was perceived negatively was the automatic scoring. Negative remarks about the usefulness of this feature were provided by the participants in the two groups equally and were particularly highlighted during the interviews. According to participants this feature was the least comprehensible as it was presented in the form of numbers that did not help in highlighting their pronunciation mistakes and, therefore, did not help them work on their pronunciation problems. For example, Wafa from the collaborative CAPT group explicitly stated during her interview that the scores were more confusing than helpful to her. According to her, the scores also created a bit of a competitive environment where she felt that she has to get a better score than her peers. These negative PU reports on scores were also raised as participants of the individual CAPT group who stated that they did not trust the scores given the multiple speech recognition failures already taking place in the program. Therefore, participants were suspicious of the validity of the automatic scores as they felt that they did not represent their pronunciation output and, consequently, were not interpretable. For this reason, Issam from the individual CAPT group reported that he regarded the automatic scores as only "a general average" that evaluated his pronunciation output approximately. In the same time, he stated that he preferred to focus his attention on the audio samples and speech visualization features to monitor his performance.

4.3.3 Individual case description of participants' perceptions

This section provides a narrative description of individual cases using evidence from the learning log and interview reports. Since only three participants from each group were interviewed, this individual case description focuses on six cases, three from each training group, to have inclusive results. Therefore, the individual case description included the following cases: Wafa, Ikram, and Selma from the collaborative CAPT group, Okba, Issam, and Mourad from the individual CAPT group. The individual case descriptions are presented to provide a different perspective on perception results and investigate the differences highlighted in group results. Such results show if the CAPT features presented the group cases section as contributing to PU and PEU were consistent

within each group. This section first starts by collectively introducing the PU and PEU results of the six participants to highlight the patterns and trends among students and groups. The results of each individual participant are then presented separately. Each individual description includes the participant's overall perceived usefulness and perceived ease of use. Additionally, the description of each case delves into the training features and reasons that made from the CAPT useful or easy, as reported by participants. Figure 4.7 below shows a comparison of participants' PEU in interviews and learning logs.

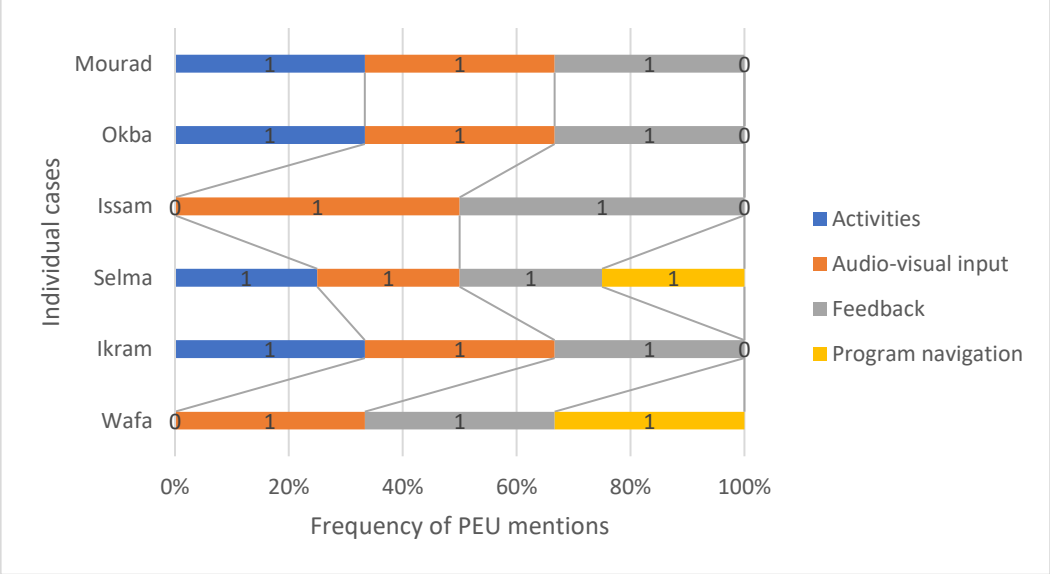


Figure 4.7 Contributing aspects for participants' PEU of CAPT

Individual case PEU results also showed consistency with group case results. Frequency of PEU mentions were well spread among participants giving more reliability to group results. Based on the figure above, feedback is clearly the most influential CAPT feature in terms of perceived ease of use. All the participants reported, at some point in their interviews or learning logs, that feedback was a feature of the training that contributed to the ease of using the program. Similarly, yet with lower mention frequency than that of feedback, activities were the second most contributing feature to participants' PEU as it was mentioned by two participants in each group. Two CAPT features, however, made a difference among participants in the collaborative CAPT group, namely, program navigation, and the use of CAPT in classroom. Such features, as highlighted in the group case results, were perceived to be contributing for PEU in the collaborative CAPT group; meanwhile, they were absent in the individual CAPT group. Figure 4.8 bellow provides comparison of participants' PU in interviews and learning logs.

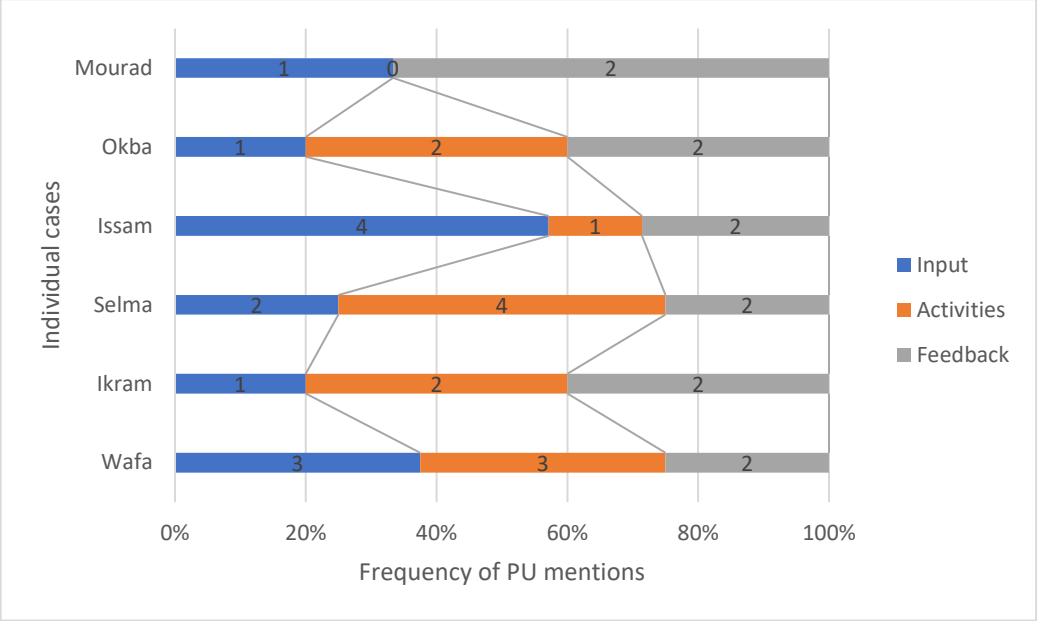


Figure 4.8 Contributing aspects for participants' PU of CAPT

Individual case results of PU presented in the figure above show a consistency with the results of groups cases presented in the previous section. The differences, manifested through the frequency of mentions and reflecting the key features for participants, yielded similar results to those of groups. More importantly, individual results showed that mentions of CAPT features that contributed to participants PU were well distributed among participants. Except for the case of Mourad, all participants mentioned three CAPT features, such as instruction, activities, and feedback, as contributing to their positive PU perceptions, yet with varying degrees of emphasis. In consistency with group results presentation, the audio-visual input was clearly an influential feature for both groups. Program instruction was mentioned by all participants with fluctuating, mention frequency by participants in each group. Feedback too was, as previously shown in group results, equally useful for all the participants. Activities, on the other hand, were the only PU features that showed a slight difference between the two training groups. Activities were the only feature that was not mentioned by all the participants. Moreover, similar to groups results, the frequency of its mentions was higher in the collaborative CAPT group than the individual CAPT group. While the frequency of mentions can highlight the influential features of CAPT, it does not reveal the reasons behind those mentions. Therefore, the following section provides a narrative description of individual case perceptions to understand why participants mentioned such features as contributing to their PU and PEU. This will highlight any reasoning patterns, if any are noticed, for PU and PEU mentions among participants and groups.

4.3.3.1 Case 1. Wafa – Collaborative CAPT group

According to Wafa's learning log and interview reports, the CAPT system Tell Me More was easy to use and useful for prosody practice. According to her, the easiness of navigating the program and feedback interpretation was a primary feature that contributed to such perceptions. A CAPT feature that was highly mentioned by Wafa was the audio-visual instruction provided by the program. According to her, the program illustrated prosody features in an innovative way that could not otherwise be delivered with traditional tools in the classroom. Wafa's emphasis on the positive usefulness of program instruction was consistent throughout the whole study. According to her learning log reports, instruction helped her understand the mechanisms of each prosody feature differently. The visual representations (i.e. soundwaves and intonation indicators) helped her identify stress and intonation directions; meanwhile, the native speech models (native speaker models) were crucial for understanding rhythm. More importantly, Wafa reported trust for instruction because it was based on native speaker models. This was, according to her reports, a key motivating feature to follow the audio-visual instructions.

With similar frequency of positive PU mentions, Wafa's perceptions of activities were also very positive. While she had the chance to practice with both, "listen and choose the correct answer" and "listen and repeat" activities, she emphasized the latter. While this type of activities was criticized by participants in the individual CAPT group for being repetitive, Wafa found it very productive. In this regard, she reported, "it (the "listen and repeat" activity) gave me a chance to practice comprehensible listening to native speech models and pronunciation at the same time" (interview). Interestingly, she provided the same "native speaker" argument in justification for her positive PU of activities. While her positive reports of practice did not mention her training condition (collaboration) as a reason for positive PU, Wafa did not raise any negative aspects of practice with the program except for the time and amount limitations which were mentioned by most participants.

Similar to instruction and activities, but with less enthusiasm, Wafa also provided positive PU mentions about feedback. According to her reports, feedback was a valuable part of CAPT due to its ability to highlight and correct pronunciation mistakes. In her interview, Wafa said: "when I receive comment and correction to my pronunciation, it really helped me" (interview). Such qualities of feedback were constructive, according to her, as they helped her to work on her pronunciation mistakes. On the other hand, one aspect of feedback which was not appreciated by

Wafa was the automatically generated scores. Wafa doubted the usefulness of this feature as the scores did not contribute to the learning and practice.

In terms of use, Wafa's reports reflected a confidence in dealing with the program in general and its various features, namely, audio-visual instruction, feedback, and activities. Despite some use difficulties that emerged early in the study and faded away with the progress of sessions, she found program interface (UI) clear and easy to navigate. The only issue that has affected the use of the program negatively, as reported in her interview, was the technical deficiencies of the program. In this regard, she especially focused on speech recognition failures as they interrupted practice during activities. Wafa reported in her interview that the program failed to recognize her voice multiple times. This, according to her, made her practice a little bit more challenging.

In terms of the visual representation of feedback and instruction, Wafa's PEU reports were positive. However, while the interpretation of such features was reported easy, Wafa found the automatic scores confusing. According to her, these scores were adding an unnecessary pressure to the training. For this reason, she reported: "the score was confusing me. I was too focused on the soundwaves and how to use intonation or stress … but the score was not responding that I forgot the goal" (interview). While the visual highlighting and correction of pronunciation mistakes made practicing comprehensible and easy, the automatic scores limited it to numbers and added pressure.

4.3.3.2 Case 2. Ikram - Collaborative CAPT group

Overall, Ikram's training experience was characterized by the emphasis on the practical aspect of the CAPT program (i.e. activities and feedback) rather than the instructional aspect of it. In the conducted interview and her reports in learning logs, Ikram attributed her perceived usefulness of the program to two main features, namely: activities, feedback and with less emphasis instruction. Similarly, Ikram PEU reports showed that she found the program easy to use. Such positive perceptions in terms of using the program were attributed to using the program in the class, simple activities, and clear feedback.

Ikram's emphasis on the usefulness of activities and feedback was consistent in the learning logs throughout the study. While in her first encounter with the program she did not fully grasp its role, she showed a clear admiration for its activities and feedback in the following sessions. The usefulness of both types of activities "listen and repeat" and "listen and choose the correct answer" were perceived positively according to Ikram's reports in the interviews and learning logs. The "listen and repeat" were especially helpful in practicing stress and intonation as it allowed

immediate feedback on every sentence in real time. On the other hand, the "listen and choose the correct" activity (conversation simulation) gave her a chance to practice a complex feature like rhythm in a setting that simulated real conversations.

Similarly, Ikram gave a great deal of importance in her positive PEU mentions to the program feedback. In her PEU mentions, all the feedback elements were equally important as they show how well she was performing. Her main emphasis, however, was on the feedback elements that highlighted and corrected her pronunciation mistakes. In this regard, she said the following, "the feedback element that I found most helpful was the visual red highlighting of pronunciation errors... it was helpful for me" (interview). As for the automatic scores, while she was clearly concerned about her performance, Ikram did not particularly mention scores as a positive element in her training experience.

In terms of using of the program, Ikram did not face, according to her PEU reports, a lot of challenges. In fact, Ikram was the only participant during the study that was completely comfortable with using the program in the classroom with other students. While most participants reported that they would rather use the program in a safer environment (if they had a choice) far from their peers, Ikram did not face similar challenges. Additionally, she reported that feedback was a key element in the ease of using the program. While it highlighted and corrected mistakes immediately and accurately, the feedback was also easy to interpret and understand. This made it easy for her to spot her errors and work on them. However, technical issues in speech recognition were the only challenge that Ikram reported negatively in the PEU sections of her reports. For that, Ikram reported: "I had to repeat the sentence many times so that the program gets it" (interview). According to Ikram, the program did not seem fully ready to recognize her speech sometimes causing a noticeable interruption in training. This program inconsistency added a challenge to her practice but did not significantly affect the ease of using the program.

4.3.3.3 Case 3. Selma - Collaborative CAPT group

Overall, Selma perceived the computer assisted pronunciation training experience as both useful and effort free. Like her groupmates, she found the CAPT program useful for her learning and practice of prosody. All the three main aspects of the program (namely instruction, activities, and feedback) were positively mentioned in her learning logs and interview. Interestingly, Selma reported a particular emphasis on the usefulness of activities. This emphasis was slightly higher than that of her groupmates and significantly higher than any participant in the individual CAPT

group. Despite some faced technical deficiencies in the program, Selma also reported that the program was easy to navigate, activities were straightforward, and feedback was clear.

According to Selma's reports, the most important aspect of the CAPT program was activities. She especially referred to the "listen & repeat activities" that allowed her to receive immediate feedback and pass to the next sentence based on that feedback. Selma attributed such positive PU perceptions to the contextualized nature of activities. According to her, sentences and utterances in the "listen and repeat" were not given in isolation. Each sentence or utterance was accompanied by a topic. For example, sentences/ utterances about fishing were provided with pictures of lakes and the sound of water. More importantly, such activities provided a range of statements like questions and expressive sentences. This, according to Selma, allowed for a diversified and meaningful practice. This was also mentioned in the conversation activities (i.e. "choose the correct answer" activity). In this regard, she said: "The conversation activity in the sentence rhythm session were helpful as they helped us focus on meaning" (interview).

Additionally, but with less frequency of positive PU mentions, Selma found the visual aspect of the program very helpful. This was clear from her mentions of instruction and feedback during the syllable stress, sentence stress, and intonation sessions. According to her learning log reports, the visual representations illustrated the prosody features in a way that was easily interpreted and understood. Selma found the soundwaves reliable in addressing both word and sentence stress. On the other hand, she reported that the intonation indicator played a complementary role in intonation practice. As for feedback, and like her groupmates, Selma pointed out the same useful features, namely: highlighting pronunciation mistakes. In consistency with her peers, Selma was mainly focused on feedback to highlight her pronunciation mistakes rather than automatically judge her through scores. This was clear from her interview report: "the most helpful type of feedback was the highlighting in red. The one that indicated the words I didn't pronounce well in a sentence" (interview).

Most of Selma's PEU reports were positive as she found the program easy to use. According to her, the main features of the CAPT program did not cause many challenges. She was able to manage the user interface of the program, practice with activities, and understand feedback without requiring a lot of support from the teacher. Nevertheless, in addition to those positive PEU mentions, Selma also pointed out that speech recognition issues posed a little challenge for her practice. In this regard, she reported: "the program sometime doesn't hear me well … I had to repeat what I am saying several times" (interview). Similar to other groupmates, this made it a little

bit harder to complete the activities. Another reported difficulty was the use of such technology in the classroom. In the interview conducted with her, Selma reported that she would be more comfortable using speech technologies at home. This is mainly to train in a more comfortable self-paced environment far from the judgements of peers in the classroom.

4.3.3.4 Case 4. Okba - Individual CAPT group

Okba from the individual CAPT group had conflicting ideas about the CAPT program. On the one hand, he found the program useful to learn about and practice prosody. On the other, he doubted some aspects of practice like repetitiveness. Such contradicting views, however, did not affect his positive PEU mentions about the CAPT program. According to Okba, while practice with the program may have drawbacks, the use of the program was easy. His perceptions about the ease of use were attributed to activities simplicity and the clarity of feedback. The following section provides an in-depth description of Okba's PU and PEU recorded in learning logs and the interview.

A clear example of Okba's colliding ideas about the usefulness of CAPT was those mentioning activities. In his positive PU mentions of activities, he perceived activities, especially those of "listen and choose the correct answer", to be innovative and effective. Okba attributed such positive views about activities mainly to the native speech models which not only helped in pronunciation, but also listening. These, according to him, gave a good example and added an interactive aspect to the practice. Aside from "listen and choose the correct answer" (or conversation activities as reported by Okba), the "listen and repeat" activities were perceived by Okba as often repetitive. This was, according to his reports, especially noticeable after spending a considerable time practicing. Feedback was also reported by Okba as one of the most useful features of the program. This feature, according to him, was in many cases capable for raising his awareness of key pronunciation mistakes. In his positive mentions of feedback, he focused on how the program visualized his speech. This feature, according to him, was a motive to practice more, especially as there was a native speaker model to compare output with. On the other hand, Okba was doubtful about the program's ability in raising his awareness of the important pronunciation mistakes. Because of the programs' technical issues and repetitiveness, Okba was skeptic about the program's capability in highlighting pronunciation errors and enhancing his performance. Unlike activities and feedback, Okba's mentions of instruction in learning logs and interview were few and brief. With exception of one positive PU mention of instruction, Okba did not seem to focus on the contribution of instruction. The second session dealing with stress was the only session in which a visual instruction feature was mentioned by Okba. In this session, Okba reported that soundwaves

were useful as they helped him identify stress placement within and between words. According to him, identifying syllable stress or content words stress would be difficult if one relied only on native speech models.

Overall, Okba found the CAPT program easy to use. According to him, the main features of the program (i.e. activities and feedback), were simple. For example, activities did not demand some exceptionally high technical capabilities. Moreover, the personalized feedback presented was easy to understand and, as expressed in the interview, intuitive (intonation indicator/ and showing emphasis in soundwaves). The main challenge in using the program, according to Okba's reports, was the repetitiveness of practice. According to him, this was even more challenging when attempting to perform a sentence with a level close to that of the model. As reported in his interview, Okba said: "the main challenge was trying to get the best score … not with the same accent but high according to the program standards" (interview). Interestingly, Okba, unlike many other participants did not blame this repetitiveness of practice on the speech recognition issue of the program. Moreover, similar to most participants, Okba also reported that he was not completely comfortable with using the program in the classroom. Nevertheless, he reported that the difference between the two training environments would be minor for him. In this regard, he reported: "I can use the program in both situations, but generally I prefer to use it alone at home" (interview).

4.3.3.5 Case 5. Issam - Individual CAPT group

Issam from the individual CAPT group perceived the CAPT system as both useful and ease of use. Like his peers in the same group, Issam was too reliant on the visual aspects of the CAPT program, especially those related instructions. Meanwhile, the usefulness of activities or practice was rarely mentioned in his reports. Similar to perceived usefulness, Issam also attributed his perceived ease of using the program to the visual aspects of the CAPT program, namely feedback. Meanwhile, his negative PEU mentions revolved mainly around the repetitiveness of practice.

In justification to his positive perceived usefulness of the program, Issam mainly referred to the visual aspects which were manifested through instruction and feedback. Throughout all of his learning log reports, Issam mainly referred to the visual representations of the practiced utterances and the accompanied instruction for using prosody. The following are excerpts from Issam's learning log in which he reported the role of the program when practicing each prosody feature.

Session two (stress): "The high pitch and the low pitch, stressing specific words"

Session three (intonation): “Pitch in questions (the program helped me notice the different uses of intonation in questions)”

Even when referring to practice or activities, Issam mainly mentioned the visual representation that helped him know how to use a particular prosody feature. This was especially clear from Issam’s description of activities during the interview when he said: “I liked that it (the program) was focusing each time on some aspect of pronunciation … for example, when expressing shock, the program will make you pay attention to intonation and how to use it” (interview). Furthermore, Issam’s focus on the visual aspect of the program was even clearer when looking at his positive mentions of feedback. Like many other participants, he found feedback useful in highlighting his pronunciation mistakes, namely the stress of content words through soundwaves and intonation through the intonation indicator. Aside from the usefulness of the visual aspect, Issam also perceived feedback positively “because it was fast and immediate” (interview). This immediacy, according to him, helped him work on his pronunciation errors through fast and personalized feedback.

In terms of using the program, Issam’s PEU reports were very positive. He mainly attributed the easiness of using the program to its visual aspects and feedback which made training more meaningful. Although feedback was the most contributing feature to his PEU mentions, Issam reported needing more than one session to be able to interpret and understand it, as the following interview excerpt indicates: “at the beginning, I didn’t understand it. But with time I started to get it” (interview). The main challenge that was reported by Issam was trying to achieve a visual representation of his speech output similar to that of the native speaker. For this, Issam said: “I had to repeat many times to make it exactly like the model. I think that was challenging for me” (interview). Similar to other participants in the individual CAPT group, while Issam found achieving a close model pronunciation repetitive challenging, he chose repetition rather than blame the speech recognition limitations. Additionally, although he was using the CAPT program individually, Issam said that he would rather use the program at home. According to him, self-paced training and flexibility are the main motives to practice alone at home rather than in the classroom.

4.3.3.6 Case 6. Mourad - Individual CAPT group

Overall, Mourad perceived the usefulness of the CAPT program positively. Like his peers in the individual CAPT group, Mourad found the audio-visual aspects of the program manifested through the visual illustration of prosody and feedback as a guide to his learning and practice. According to

Issam, practice through repetition would not be as meaningful without such features. Audio-visual aids in the program, according to Mourad's reports, also played an important role in his positive PEU perceptions of practice. Aside from that, Mourad found the program challenging to use independently. The following section details Mourad reports generated from learning logs and the interview.

While his learning logs vaguely reported that the program was useful as "It made it (prosody practice) easier and quicker", his positive perception of the program's audio-visual elements during the interview was clear. Mourad repeatedly mentioned the helpful role of speech models and their visual representation in guiding his understanding and practice of the prosody features. For example, Mourad mentioned how soundwaves, supplemented with the audio models, made it easier to identify stressed syllables and content words. Such features, according to Mourad, made it easier to understand how stress can influence meaning. Additionally, Mourad also addressed the contribution of feedback to his training experience. According to the interview, mentions of feedback mainly referred to the highlighting of mistakes. Interestingly, Mourad was more interested in the program showing his pronunciation mistakes rather than focusing on comparing the native speech models with his output. This highlighting of mistakes was equally contributed by soundwaves and intonation indicators. In the meantime, Mourad regarded the generated scores as an overall reference of his performance but not as a reliable judgment. As stated in his interview, scores were only a general reflection of his performance and were not considered as the goal of practice.

Aside from visual illustration of prosody and feedback, Mourad was not convinced about the usefulness of the activities. This was clear through multiple negative PU mentions that touched on the repetitiveness of the practice. In answering the question about the usefulness of the activities, Mourad replied: "listening and repeating with just the program is not that helpful. We need to use the practice in a more contextual activity" (interview). According to Mourad, this was a limitation of practice as repeating statements lacked meaningfulness and affected his motivation to use the appropriate stress and intonation. With such limitations, he reported that additional training time would be needed. "I still feel that I need more time to practice with the program … so I can say that I really benefited from it, but I need more time" (interview).

In terms of using the program, Mourad found the program generally easy to use. With the exception of difficulties in browsing the program and minor technical issues, Mourad PEU mentions were predominantly positive. Browsing and navigating the program was the main

challenge that affected his use of the program. When mentioning this point during the interview, Mourad said: “I had issues with the program. It was kind of difficult to browse the software, choose and use the activities in the program” (interview). He further justified this due to the unfamiliarity with the user interface (UI) of the program. Despite facing issues related to program browsing, Mourad reported: “in the activities, the program was easy to use, and I didn’t find a problem” (interview). In other words, the student did not report any difficulties during the actual practice of “listen and repeat” and “listen and choose the correct answer” activities. According to him, the structure of activities was simple. As for interpreting the audio-visual aspects of the program, Mourad reported that it was “obvious and intuitive” (interview). The highlighting of miss-emphasis on content words and wrong uses of intonation was clear and easy to interpret. Furthermore, similar to his peers in the individual CAPT group, he did not focus on the speech recognition problems despite acknowledging them. While he reported that there were obvious speech recognition problems, he was more invested in enhancing his pronunciation output.

Chapter Five: Discussion

This chapter discusses the results generated in the current study in light of the previous literature on CAPT and the adopted sociocultural theoretical framework. The chapter is divided into three main sections, each focuses on the results of one of the research questions. The first section interprets and discusses the pronunciation learning results generated from the analysis of the read-aloud tests conducted with the Algerian EFL students before and after the study. This part mainly focuses on the extent to which collaborative and individual CAPT of prosody features affected participants' pronunciation learning results as measured by their prosodic quality and overall pronunciation comprehensibility. The second section interprets and discusses the classroom observation results generated through the camera and screen recordings during the training sessions. This section addresses the amount and type of support from the teacher by participants when working either individually or collaboratively with the CAPT system to practice prosody features. The third section interprets and discusses the results generated from the learning logs and interviews. This section focuses on the influence of individual and collaborative CAPT of prosody on participants' perceived ease of use (PEU) and usefulness (PU) of the technology.

5.1 The Influence of Collaborative CAPT of Prosody on Participants' Pronunciation Learning

Overall, no significant pronunciation learning developments were found neither between the pre-test and post-test nor between the three groups of the study (in both tests). The results of the pronunciation learning tests indicated only slight learning progress in the training groups (collaborative CAPT group and the individual CAPT group) in the use of prosodic features in favor of the individual CAPT group. Such small gains in prosody, however, were not substantial and did not translate into significant learning progress in EFL students' overall pronunciation comprehensibility. As for the control group receiving no treatment, the pronunciation learning test results did not show any differences between the pre-test and post-test. In light of the CAPT and pronunciation literature, a very likely explanation for the non-significant learning differences between the groups of the current study is the limited duration of the intervention (6 hours). Such limited practice duration, and while it resulted in small gains on a prosodic level in the training groups, it was not enough to highlight significant differences between the collaborative and individual modes of access to CAPT of prosody. Such interpretation is in line with the previous CAPT literature Elimat and AbuSeileek (2014) and Tanner and Landon (2009) showing that the

effectiveness of a particular mode of access on EFL students' pronunciation requires a minimum of eight to thirteen weeks of practice to detect significant learning differences. Along with the duration of intervention, the lack of significant learning development in terms of overall comprehensibility can also be explained by the predominant prosodic focus of CAPT in the current study with no attention to phonemic features. Such features, as emphasized in the pronunciation literature (e.g. Munro & Derwing, 1995; Saito et al., 2016), are also equally correlated with the perceived comprehensibility of EFL learners. This first section of the discussion chapter interprets and discusses the pronunciation learning results obtained from the participants of the three groups through the read aloud tasks conducted before and after the CAPT intervention. The section is divided into two main parts, each discussing one learning results of one of the pronunciation criteria on which participants' pronunciation was assessed: namely, 1) prosodic use (syllable stress, sentence stress, intonation) and 2) overall comprehensibility. The results are interpreted and discussed based on the design of the current study (and its circumstances) and the relevant CAPT and pronunciation literature to provide logical explanation for EFL participants' pronunciation performance.

5.1.1 The influence of collaborative CAPT of prosody on participants' prosodic quality

Despite the study being dedicated to prosody practice under two modes of access, no significant learning developments were found between the three groups in both tests. As pointed out earlier, such lack of significant learning differences in prosody use between the two tests and the training groups is likely due to the limited time of the study. Such interpretation is in line the results of previous CAPT studies employing the technology through individual and collaborative modes for prosody practice and aiming for improvements in EFL students' use of prosody features (Hardison, 2004; Luo, 2016; Tanner & Landon, 2009). A common finding within the CAPT studies focusing on prosody is that they require a minimum of 10 weeks for significant learning development to be detected in EFL learners' pronunciation. This is particularly important to consider with low-intermediate to intermediate EFL learners where students first development their perception of the suprasegmental features and then proceed to produce them. An example of that is the study of Tanner and Landon (2009) in which 75 EFL students were engaged in 13 weeks of individual practice of supra-segmental perception and production using the CAPT technology CPRs (Cued Pronunciation Readings). The duration of the study helped participants to achieve significant learning developments in their perception of stress and intonation and their production of word stress. Similar results were also found in the study of Luo (2016) where 55 Chinese EFL students

engaged in 12 weeks of CAPT with native EFL samples and peer feedback. The results of this study showed that the EFL students engaged in CAPT made significant developments in their use of intonation variation and sentence stress after the training.

Such duration of CAPT studies does not only depend on the number of sessions or weeks of training but is also determined by how extensive they are in terms of the actual practice provided for students. For example, in Hardison's (2004) study that investigated the effectiveness of condensed individual supra-segmental practice on the pronunciation of 16 adult English learners of French, the results showed significant learning gains in the use of prosody features in only three weeks. Although the study lasted only three weeks, the participants were engaged in 13 extensive CAPT sessions each lasting 40 minutes. Similarly, Seferoğlu (2005) found significant developments in the use of stress and intonation by 40 Turkish EFL students after extensive three weeks of individual CAPT practice that included both segmental and supra-segmental components. On the other hand, long term studies that don't provide extensive practice can be very limited in detecting significant differences in the use of prosody features. For example, in the study of Tsai (2015) investigating the effectiveness of collaborative and individual access to CAPT for ten weeks with 90 adult Taiwanese EFL learners, only small gains were found in timing and intonation and no significant learning differences were detected. While the study lasted for ten weeks, it is very likely that the limited number of sessions (1 session a week) may have contributed to the lack of significant learning results. Likewise, short term studies in terms of frequency and duration of sessions that are investigating individual or collaborative CAPT of prosody (namely, stress and intonation) often failed to detect significant learning developments in the use of such features by EFL students. For example, in the study of Hincks and Edlund (2009), which investigated the influence of four weeks of individual CAPT of prosody on the use intonation by 14 adult Chinese EFL students, no significant learning results were found. Although slight improvements were detected in students' intonation variation, the statistical tests revealed no significant developments between the pre-test and post-test results.

Although the developments in EFL participants' use of prosody features were insignificant in the current study, small learning gains were noticed in the two training groups when compared to the control group. According to overall prosody results, the prosodic error ratio in the individual CAPT group decreased from .152 in the pre-test to a ratio of .110 (Diff = .042). Meanwhile, the overall prosodic error ratio in the collaborative CAPT group decreased from .140 in the pre-test to .112 in the post-test (Diff = .028). These small gains offer a positive indicator for the effectiveness

of ASR based CAPT of prosody under both individual and collaborative access modes. Moreover, such results, and in line with the findings of some previous CAPT studies (e.g. Tanner & Landon, 2009; Tsai, 2015), support the interpretation implying that if more time was dedicated to the training sessions, significant prosodic developments would be detected.

The overall prosodic results also reveal slightly more prosodic development in the individual CAPT group (Diff = .042) over the collaborative CAPT group (Diff = .028). This is very likely due to the nature of individual CAPT which offer longer practice times for EFL participants. Unlike participants with collaborative access to CAPT who expected to share their practice time with their peers, participants in the individual CAPT group enjoyed full access to the technology. Similar results were also found in CAPT studies investigating different modes of access to the technology for prosody practice where EFL students with individual access to CAPT achieved more learning gains than their peers in the collaborative CAPT groups (e.g. Elimat & AbuSeileek, 2014; Tsai, 2015, 2019). However, unlike the interpretation of Elimat and AbuSeileek, who attributed the development of participants practicing individually to the low levels of anxiety in individual CAPT, the interpretation of the small prosodic learning gains in the current study are more in line with Tsai's (2015, 2019) emphasis on the role of practice time in individual CAPT. Under such mode, EFL learners benefited from a larger exposure to native models (which helps their perceptions of the features), longer practice opportunities, and more audio-visual feedback. On the other hand, the participants in the collaborative CAPT group were expected to grant their peers equal practice time and, therefore, partially sacrificed their exposure time with such features of the technology.

When looking at the prosody use results separately, the individual CAPT group made more development in the use of sentence stress and intonation than the collaborative CAPT group; meanwhile, the collaborative CAPT group made slightly more developments in syllable stress than the individual CAPT group. Similar to the interpretation for the overall prosody results, exposure time to the CAPT technology under individual and collaborative access modes may have contributed directly to such differences. It is very likely that the longer practice duration offered by nature of the individual access mode to the technology may have helped the participants to focus on prosody features that influence utterances and sentences. Such interpretation is in line with the predictions of CAPT literature highlighting the strong potentials of individual exposure CAPT and its main features, namely: pronunciation input, slef-paced practice, and immediate personalized feedback (Depot, 1983; Hardison, 2004; Neri et al, 2008). The results of Tanner and Landon (2009) and Seferoğlu (2005), for example, showed that individual access to CAPT provides EFL students

with rich exposure to the audio and visual representations of sentence stress results. This allows EFL students to perceive and produce the different uses of emphasis on content words and function words in a variety of sentences. In terms of intonation, individual CAPT also allows for perceiving and practicing more uses of intonation in various types of utterances and sentences. According to the CAPT literature, this gives EFL students more chances to listen to more examples of intonation, stretch the resources of their voices to use proper intonation in obligatory contexts, and work more on their intonation problems with the audio-visual feedback (Hincks & Edlund, 2009; Seferoğlu, 2005).

On the other hand, the slower pace of practice in the collaborative CAPT group (see **Table 4.10**, Screen capture results) may have allowed EFL participants in this group to pay slightly more attention to syllable stress in the multisyllabic words than prosodic features which deal with long utterances and sentences (i.e. sentence stress and intonation). Such interpretation is supported by the CAPT literature when considering the fact that most learning gains in syllable stress are often achieved by EFL students practicing word pronunciation. For example, the results of Neri, Mich, et al. (2008) and Tanner and Landon (2009) showed CAPT which includes word pronunciation activities often leads to gains in syllable stress. In the current study, the sharing of practice time and the peer discussion that arrived, may have allowed participants in the collaborative CAPT group to notice word stress mistakes and work on them. The results of prosody practice were, however, insignificant and therefore don't allow for assertive conclusions about such group differences.

Another possible explanation for the slightly more prosody learning development in the individual CAPT group compared to the collaborative CAPT group is the more frequent assistance interventions from the teacher in this group. According to the classroom observation results generated in the current study, the teacher intervened a total of 79 times to help the participants in the individual CAPT group with technical and non-technical issues during the observed sessions. Meanwhile, the teacher only intervened a total of 35 times in the collaborative CAPT group. This higher frequency of assistance interventions may have given participants in the individual CAPT group a slightly better edge in using the CAPT system, understanding its audio-visual input, and benefit better from its activities and feedback. Such interpretation is particularly likely when considering that the CAPT literature emphasized the effective role of the teacher in helping students overcome the technical challenges in the use of CAPT and interpreting its visual representations of prosody features (e.g. Anderson-Hsieh, 1994; Levis, 2007). Other CAPT studies also highlighted that students often trust the teacher feedback when using CAPT more than their peers' feedback

(Tsai, 2015). Moreover, some studies on the effectiveness of pronunciation instruction showed that teacher-led pronunciation instruction, when it involves varied input, practice opportunities, and corrective feedback, can lead to better pronunciation learning development than CAPT (J. Lee, Jang, & Plonsky, 2014). It is, however, worth noting that the teacher's assistance interventions were mainly to provide guidance for participants to properly benefit from the features already provided by the CAPT system and cannot be compared with the fully teacher-led prosody instruction. Additionally, and while the teacher assistance interventions were more frequent in the individual CAPT group, they were provided for participants in the two groups, in the same way, to properly use the CAPT system.

5.1.2 The influence of collaborative CAPT of prosody on participants' pronunciation comprehensibility

Similar to the prosody use results, no significant learning differences were found in terms of overall comprehensibility between the three groups. The results of EFL students' perceived comprehensibility in the two training groups either stayed at the same level or slightly decreased. The limited duration of the study did not allow for the marginal gains in the use of prosody to translate into gains in overall comprehensibility. Along with the short-term nature of the study, a possible explanation for such non-significant results could also be attributed to the lack of attention to phonemic features. Such components of pronunciation (i.e. vowels and consonants), according to EFL pronunciation literature, are also equally correlated with EFL speech comprehensibility along with prosody features. The following two sub-sections interpret and discuss EFL participants' pronunciation comprehensibility results in relation to the literature in more detail.

5.1.2.1 The influence of practice duration in collaborative and individual CAPT of prosody on participants' pronunciation comprehensibility

The duration of the current study (6 hours) did not allow for the small learning gains in the use of prosodic features to significantly influence the overall comprehensibility of participants in the two training groups. Such interpretation for the results is in line with the CAPT literature investigating the influence of collaborative and individual access to CAPT of prosody on EFL students' pronunciation comprehensibility and intelligibility (e.g. Elimat & AbuSeileek, 2014; Hincks & Edlund, 2009; Tanner & Landon, 2009). In the study of Elimat and AbuSeileek (2014) where individual and collaborative CAPT of prosody was investigated with 64 Jordanian EFL students, it took eight weeks of practice for significant learning development in speech comprehensibility to be detected. In terms of the mode of access, and in accordance with the current study's emphasis on

the longer exposure benefits of individual CAPT, EFL students practicing individually made more significant development in their comprehensibility when compared with the collaborative groups (pairs/ group). On the other hand, in the short term study of Chiu et al. (2007) where 49 Chinese EFL learners engaged in individual CAPT of sentences using Candle Talk for six weeks, the participants achieved only small learning developments in the use of prosody features. However, and similar to the study reported in this thesis, these small prosodic gains did not significantly influence EFL learners' overall comprehensibility. Similar results were also found in the short term study of Hincks and Edlund (2009) where 14 Chinese EFL students engaged in four weeks of sentence pronunciation practice using the CAPT technology "Snack Sound Toolkit" individually. While the training resulted in a small development in the use of intonation variation, such results did significantly affect participants' overall comprehensibility. This research-based evidence highlights the crucial role that the duration of CAPT intervention plays in order to notice significant learning differences in EFL pronunciation learning. The six weeks of the current study, and while it resulted in non-significant prosodic developments, it was not enough to detect significant developments in overall comprehensibility.

5.1.2.2 The influence of the prosody focused collaborative and individual CAPT on participants' pronunciation comprehensibility

Another possible reason for the lack of significant learning development in overall comprehensibility is the predominant focus on prosody features at the expense of phonemic practice (i.e. vowels and consonants). Such features, as highlighted by Munro and Derwing (1995) and Saito et al. (2016), are also equally correlated with EFL speech comprehensibility. In addition, evidence in CAPT studies highlights the importance of such features, alongside with prosodic features, to achieve learning progress in comprehensibility or intelligibility (e.g. Neri, Mich, et al., 2008; Tanner & Landon, 2009; Thomson, 2011; Tsai, 2015; Wang & Munro, 2004). This is mainly because the development of vowels and consonants' pronunciation accuracy plays a great role in the perceived intelligibility of words and, in turn, the overall comprehensibility of sentences.

In line with the interpretation of the current study, similar results were found by Tsai (2015) where 90 Taiwanese EFL students engaged in suprasegmental practice with MyET for 10 weeks. While EFL students achieved slight learning results in the production of intonation, no development was detected on the level of pronunciation intelligibility. In the study of Tanner and Landon (2009) focusing on prosody features, and although EFL students made significant learning developments in using word stress, the pronunciation learning results did not reveal significant development on the

level of comprehensibility. The author attributed the negative results to the short duration of the practice sessions (10 minutes per day for 11 weeks). On the other hand, significant learning development in overall pronunciation comprehensibility was often noticed when CAPT revolved around or included phonemic or word-level pronunciation. In Wang and Munro (2004), for example, the sixteen native Mandarin and Cantonese EFL engaged in individual CAPT of three English vowel contrasts for more than eight weeks achieved significant development in their pronunciation intelligibility. Similar results were also found by Thomson (2011) with the 22 EFL learners who were engaged in only three sessions of vowel focused CAPT, and in Neri, Mich, et al. (2008) where 28 young EFL learners were enrolled in word-level CAPT for four weeks. Both studies found a significant learning development in overall EFL pronunciation comprehensibility demonstrating a high correlation between the practice of phonemic features and such measure of pronunciation learning.

5.2 The Influence of Collaborative and Individual Access Modes to CAPT of Prosody on the Amount and Type of the Support Needed by Participants

Overall, as the results showed, the students practicing individually required more technical and non-technical guidance from the teacher, with a total of 79 teacher support instances, than their counterparts who were practicing prosody with CAPT collaboratively, with a total of 35 teacher support instances. Based on the classroom observation results, the technical support instances from the teacher, which revolved around the use and function of the CAPT system, were recorded 32 times in the individual CAPT group, while 17 instances were recorded in the collaborative CAPT group. Moreover, the non-technical support instances from the teacher, which revolved around the training of prosody features, were recorded a total of 47 times in the individual CAPT group and 18 times in the collaborative CAPT group. Such results suggest that the collaborative CAPT of prosody at the computer allowed students to recognize, share, and tackle their technical and non-technical challenges together before requesting support from the teacher. Such an interpretation is in line with the CALL literature highlighting the technical and linguistic advantages of collaboration at the computer (Beatty, 2013, p. 122; Jeon-Ellis et al., 2005; Tsai, 2015, 2019). The following section of the discussion chapter discusses the classroom observation results focusing on the amount and type of the technical (subsection 5.2.1) and non-technical (subsection 5.2.2) support instances required from the teacher under each mode of access to the CAPT system. The first part of each subsection starts by summarizing the results of the type and amount of support needed from the teacher in each group and then interprets and discuss the results in light of the relevant CAPT

literature and the theoretical framework. The second part of each of the following subsections recapitulates on the evidence of student-student support interactions in the collaborative CAPT group and discuss their influence on the required support instances from the teacher in this group.

5.2.1 The technical support required by the participants practicing individually and collaboratively in CAPT

The results from classroom observation showed that the participants in the individual CAPT group required their teacher's technical support 32 times in total, while the participants in the collaborative CAPT group required the teacher's help 17 times in the same duration. The technical support provided by the teacher revolved around three main themes, the use of the program and the functioning of software and hardware of the program (see **Chapter 3**, Section 3.6.2 The analysis of classroom observation data). With regard to the support required for the use of the program, the teacher support interventions were mostly related to the program navigation, with a total of 26 support interventions observed in the individual CAPT group and 11 instances of support interventions in the collaborative CAPT group. The teacher's support for displaying the feedback on the program was required only by students from each group. Meanwhile, the support provided on the software and hardware functioning was less frequent, with a total of five display and audio support interventions in the collaborative CAPT group and only two hardware and software audio support interventions in the individual CAPT group. The following subsections provide a detailed discussion about the amount and type of the requested technical support that students from the two training groups required.

5.2.1.1 Types of technical support in individual and collaborative CAPT

The participants in the individual CAPT group requested a significantly higher amount of teacher support than their peers who were practicing the tasks collaboratively; however, the type of support was very similar in both groups. Except for a few technical support interventions that addressed software or hardware issues, most of the technical support requested by the participants in the two groups was about the use of the program, specifically, program navigation and support with feedback display. Such results meet the expectations of Anderson-Hsieh (1992) implying that the actual use of the learning program is the only way through which participants can identify their use challenges. Although the CAPT system was introduced by the start of the training, participants faced different difficulties once they started using the program.

The major technical issue that both groups experienced was related to the use of the CAPT system's UI and particularly revolved around browsing the activities. In such cases, participants needed further support from the teacher to choose or change activities and sentences in the activities. A very probable explanation for why both groups sought their teacher's support rather than trying to solve the issue on their own is that the participants were very conscious about keeping up with the progress of the rest of the group. They did not want to stay far behind their peers in terms of practice progress and turned to the teacher for help. As noted by Jeon-Ellis et al. (2005), peer pressure could significantly affect students' classroom behavior. And while such peer pressure can easily take place in the collaborative CAPT group where participants can notice how their peers progress with activities, the source of such behavior in the individual CAPT group could be the lack of knowledge about peers' progress practice. As such, participants in the individual CAPT group did not know how far their peers were progressing and, therefore, rushed for the teacher's support to make sure that they are keeping with the general pace of training in the classroom.

With regards to the CAPT system's feedback, all of the participants in the two training groups required some instances of support with the speech visualization display. And while the requests for this type of support was observed only once in each group, it is still important to recognize it and have a comprehensive picture of the support that students required. This type of support included a demonstration of stress placement through soundwaves, and intonation through pitch amplitude, in comparison to the speech models. This display was also accompanied with 2D face simulations of the sentence pronunciation. A primary explanation of the low frequency of requesting teacher's support in this regard could be that participants found this feature easy to use. After introducing the feedback features, as recommended by Molholt (1988) and Anderson-Hsieh (1992), participants were mostly able to access it. As for the requested feedback support (in the two groups), it could be mainly due to the occasional lack of trust in the automated speech visualization process on the part of participants. This could primarily be the result of them receiving feedback from the CAPT system which is not representative of their performance. Such interpretation is very likely given the speech recognition errors often found in ASR based CAPT systems (e.g. Strik, Truong, De Wet, & Cucchiarini, 2009). This is particularly plausible when considering some of the negative PEU and PU perceptions towards the speech recognition failures reported by participants in the learning logs and interviews (see **Chapter 4**, Section 4.3 Perception results).

The requests for support with the software or hardware functioning of the program were also evident but infrequent. The participants in the two training groups asked the teacher for help to

solve issues related to the sound and display during practice. The students seemed to be hesitant to tackle such types of technical issues on their own even though some of these functioning issues were minor (e.g. low battery or low audio) and participants were fully capable to resolve them on their own. Such results are similar to the findings of Tsai (2015) where participants in the collaborative group frequently requested function support from the teacher. A possible explanation for such results in the current study is that participants may have perceived issues related to the physical setup of the practice to be the teacher's responsibility. In other words, participants in the two groups considered the teacher's authority (although none was imposed) with regards to the set-up of the classroom. The following subsection discusses the lower frequency of teacher's technical support instances in the collaborative CAPT group based on the recorded interactions in this group during the training and relevant literature.

5.2.1.2 The influence of collaborative CAPT on the required technical support from the teacher

The finding that students working collaboratively needed less support is also in line with the results of previous studies (e.g. Hincks, 2003; Jeon-Ellis et al., 2005). As suggested by Jeon-Ellis et al. (2005), participants working in pairs usually take the initiative to help each other to overcome technical challenges. As a result, participants in the collaborative CAPT group required significantly less technical support instances from the teacher compared to their counterparts in the individual CAPT group for whom the teacher was the sole source of support. The obvious reason for the fewer instances of the required technical support by the participants in the collaborative CAPT group from the teacher is that they received some support from their peers. During their practice, a total of 21 peer technical support interactions were observed in this group. This amount of peer support, to use Kagan (1992) terms, may well be a piece of evidence for positive interdependence between participants in the collaborative CAPT group. In other words, the participants practicing collaboratively took initiatives to help their peers when they faced technical issues related to the use of the CAPT system even though it was not their turn or affecting their own practice. Meanwhile, the participants working individually had to take their own responsibility in overcoming such technical issues; otherwise, they had to ask the teacher for support and, thus, resulting in a higher frequency of teacher requested technical support instances. This is in line with the observation results of Hincks (2003) where students showed signs of struggling with the technology in the absence of a more knowledgeable other.

Peer support in the collaborative CAPT group centered around the use of the program instead of the issues related to the software or hardware functions. In other words, students in the collaborative CAPT group provided support only when the issue faced by their peers was related to an aspect of CAPT that they were introduced to by the start of the training. Support on the function of the CAPT system's software and hardware, on the other hand, was only provided by the teacher in this group. Such outcomes partially aligned with the findings of Tsai (2015) where students attempt to save practice time when facing issues where they only trust the support of the teacher, as the more knowledgeable other, more than their peers. Similarly, in this study, the participants in the collaborative CAPT group sought the teacher's support to resolve function issues, but they tried to solve issues such as program navigation in collaboration. Students' reliance on the teacher to solve the CAPT system's function issue could also be explained by their perceived authority of the teacher in the classroom. As Lin (2015) pointed out, even though the collaborative practice setup gives students independence and autonomy to tackle their issues, they often still consider the teacher as the leader. Thus, in the context where the study is conducted and where the teacher is viewed as responsible for students' learning, some extent of students' reliance on their teacher's help seems understandable.

While more studies would be needed to determine the type and amount of technical support that students working both individually and in groups need to enhance their learning, the fact that students in the collaborative CAPT group sought their peer support suggests that their peers were seen as an important resource, or, in Vygotsky's (1980) sociocultural terms, an important mediator when faced with technical difficulties related to the use of the CAPT system. In the absence of such peer support, participants in the individual CAPT group relied on the teacher as the only technical mediator.

5.2.2 The non-technical support required by the participants practicing individually and collaboratively in CAPT

Similar to the technical support, the participants in the individual CAPT group required significantly more non-technical support, with a total of 47 support instances, compared to their peers in the collaborative CAPT group who required a total of 18 support instances. The non-technical support in the two training groups revolved mainly around practice setup, support with tasks, and providing feedback on students' pronunciation. The following subsections discusses the nature and amount of the required non-technical support from the teacher under collaborative and individual CAPT treatments.

5.2.2.1 Types of non-technical support in individual and collaborative CAPT

Overall, most of the non-technical support revolved around management of the practice setup with a total of 35 instances in the individual CAPT group and 13 instances in the collaborative CAPT group. The support with practice setup mainly involved support with the physical setup, such as laptops, tables, and chairs, and explaining activity roles to students. There were, however, slight differences in terms of the non-technical support that students working in different groups needed. While the individual CAPT group required both the physical and role assignment support, the collaborative CAPT group required only the help with the physical setup of the sessions. The need for more different types of non-technical support by the students working individually further confirms that the teacher served as the major resource in mediating their learning. While it seems reasonable to seek a teacher's support in such instances, an excessive reliance on the teacher could, however, lead to passiveness in students' learning. As observed in Lin (2015), students working individually tended to work passively as they believed that it was the teacher who was the main manager.

The results of the collaborative CAPT group showed more students' independence in terms of managing their turn taking during practice. In other words, participants in this group mostly took their responsibility when making decisions about their practice time. Such results, as suggested by Kagan (1992), Roschelle and Teasley (1995), Warschauer (1997) and proponents of collaboration at the computer like Beatty (2013), reflect an autonomy on the part of participants practicing collaboratively. The collaborative practice process may have played an important role in engaging students to take responsibility in managing their training to ensure an equal practice time for them and for their peers. However, such autonomy was limited to turn taking as participants in the collaborative CAPT group still required teacher support when dealing with the physical set-up of the classroom. Such results, and similar to the function issues of the CAPT system, could also be explained by a perceived authority of the teacher when dealing with issues related to the physical setup of the classroom. This is possibly a result of the participants' educational culture whereby, as highlighted in Boudersa and Hamada (2015), some teachers tend to assume a lot of power in the classroom. Such teaching approach, and despite the collaborative nature of practice in this group, may have contributed to the participants' avoidance of intervening in the physical setup due to their perceived hypothetical boundaries of the teachers' responsibilities.

The second non-technical issue that required the teacher's support was the clarification of activities instructions with a total of 11 support instances in the individual CAPT group and five

support instances in the collaborative CAPT group. This type of support in the two training groups revolved around the explanation of instructions before and during CAPT activities. The need for less support with instructions in the collaborative CAPT group is very likely related to the interaction taking place between participants. As the results from the classroom observation revealed, in contrast to the students working individually and relying on the teacher's explanations, much negotiation in terms of the understanding of the tasks was observed in the collaborative CAPT group. In agreement with the expectations of Beatty (2013) and the results of Tsai (2015), participants working together in CAPT often contribute to their peers' understanding of the activities and goals.

Another important finding was obtained in terms of the participants' need for feedback with their pronunciation. The participants in both groups did not require much of their teacher's feedback on their pronunciation. With regard to the students working individually more specifically, only one instance of students' request for feedback was observed. This was apparent as the teacher only intervened once for this purpose with the individual CAPT group to provide an elicitation feedback on a student's pronunciation output. This was to help a participant who was struggling with a sentence. Such low frequency of teachers' support instances is likely to have originated because of the presence of an audio speech model for students to compare their pronunciation with. Such speech models served as a recast feedback for participants in the two training groups. Often considered as the most common and considerably effective form of feedback in the language classroom (Nicholas & Lightbown, 2001), such form of feedback provided by the CAPT system may have also satisfied the participants' needs and made the request for the teacher's feedback unnecessary. This explanation is especially likely when considering that the speech models provided by the training program (Tell Me More) are often recorded by native speakers, and that the teacher was non-native. This, as noted by Chiu et al. (2007), could have, thus, added an element of credibility to the feedback from the participants' perspective.

The lower frequency of students' demand for the teacher's feedback could be also explained in terms of the availability of a personalized visual feedback from the CAPT system. The students' reported perceptions about feedback further confirmed that with the exception of automated scores, which were perceived as unfair (see **Chapter 4**, Section 4.3.2 PU of feedback), the participants in both groups appreciated the visual feedback on their pronunciation and found stress and intonation visualization particularly useful. Similar to the results of the current study, the previous studies investigating individual CAPT (e.g. Chiu et al., 2007; Stenson et al., 1992; Tsai,

2006), and collaborative exposure to CAPT (e.g. Tsai, 2015, 2019) also observed that students' reliance on the technology's feedback on their output was prevalent.

In the collaborative CAPT group, the observed negotiation of meaning instances may have also contributed to the absence of teacher's feedback requests. Unlike the finding of Tsai (2015), where participants considered working with their peers to be tedious, the results of the current study are more in line with evidence in L. Jones (2006) and Ewing (2000) highlighting a promoted share of feedback in collaborative oral activities with CALL. Collaborative access to CAPT, therefore, may have played an important role in highlighting the pronunciation problems of participants and working on them. This, along with the visual personalized feedback, has consequently removed the need for further feedback in the collaborative CAPT group. The following section discusses the influence of student-student support interactions in the collaborative CAPT group on the required amount of required non-technical support from the teacher.

5.2.2.2 The influence of collaborative CAPT on the required non-technical support from the teacher

A very likely explanation for the lower frequency requested non-technical support from the teacher in the collaborative CAPT group is the peer support taking place within this group. According to the classroom observation results, the participants in the collaborative CAPT group engaged in a total of 47 non-technical instances of peer support interactions. Such support took three main forms: 1) task-related support (mainly negotiation of meaning) with a total of 11 support interactions, 2) managing turn-taking with a total of 11 support interactions, and 3) emotional support with a total of 25 support interactions. Such interactions may have contributed significantly to helping students to overcome their non-technical CAPT practice difficulties and therefore made them rely less on the teacher.

The participants in the collaborative CAPT group seemed to take more responsibility for managing their own practice with the learning program. This included a management of turn-taking to complete activities that were recorded in a total of 11 instances during the training. Meanwhile, students in the individual CAPT group relied mainly on the teacher to manage the physical setup (laptops) and the training procedures. Such findings in the current study are in line with the works of Benson (2013), Shetzer and Warschauer (2000), and Blin (2004) highlighting the importance of the social dimension in autonomous language learning with CALL technologies. Unlike the traditional understanding which suggests that autonomous learning can only take place through self-

access to learning input and technology, results in the current study show that collaborative CAPT contributed positively to learner's independence. Participants in the collaborative CAPT group were able to manage their own practice with minimal intervention from the teacher. This was especially apparent as the sessions progressed, and participants in this group started to feel more relaxed with the program and the social learning environment.

Additionally, and in accordance with the previous literature suggesting that collaboration at the computer provides opportunities for negotiation of meaning (Beatty, 2013, p. 108), the participants in the collaborative CAPT group also took a number of opportunities to engage in discussions about prosody features and their use. More specifically, such interactions, recorded in a total of 11 instances, revolved around clarifying the role of prosody features, helping peers practice them, and providing feedback on their peers' production. The negotiation of meaning interactions, however, mostly took place during the two sessions focusing on intonation and sentence stress. A possible explanation for such observation could be that the participants in the collaborative CAPT group (and possibly the individual CAPT group) found the pitch contour representing intonation easier to understand and then to explain to their peers. Detecting word stress and sentence stress through soundwaves was a little bit more challenging for the students and, therefore, they preferred teacher's support in this regard. This, as suggested by Anderson-Hsieh (1992), could partially be due to the limited role of speech visualization in CAPT. While the visual representation features do a good job of raising students' awareness of prosody features, they still require authentic human interaction to represent them for the student.

Another form of support that distinguished the collaborative CAPT group from the individual CAPT group was the emotional interactions that took place in a total of 25 recorded instances in this group. In different occasions throughout the training, the participants in this group reacted to their peers' pronunciation attempts by laughing or encouraging each other. This finding about students' supporting each other emotionally is also evident in the previous studies, where they showed that collaborative learning creates a social, less stressful, and engaging practice environments for students (e.g. Chiu et al., 2007; Warschauer, 1996). Collaboration at the computer seems to simulate a more genuine social interaction which is different from the more formal learning interaction that takes place in a teacher-led classroom or individualistic language learning environments.

5.3 Participants' Perceptions toward Individual and Collaborative CAPT of Prosody

Overall, the participants in the two training groups provided similarly positive reports about their perceived ease of use (PEU) and perceived usefulness (PU) of practicing prosody with CAPT technology. Although the perception reports were generally brief and lacking in depth, when put together, they showed that the two groups found the CAPT system to be generally easy to use, its audio-visual input to be comprehensible and useful for their prosody perception, its opportunities for practice to be simple and effective, and its audio-visual feedback to be interpretable and useful for detecting and working on their pronunciation problems. A difference in perception results between the two groups was, nonetheless, detected in participants' PEU reports of practice with CAPT system's activities. While the participants in the collaborative CAPT group reported that the system gave them a meaningful and an engaging practice environment, their counterparts who were engaged in the individual CAPT group perceived it to be mechanical (lacking meaningfulness), and repetitive. The following two sections discuss the results of students' PEU and PU reports in more detail.

5.3.1 Participants' perceptions towards the ease use of collaborative and individual CAPT of prosody

In terms of using the CAPT system, both groups provided positive PEU reports and commented on similar CAPT features. From these reports, the following four main themes emerged: CAPT system's overall use and UI navigation, CAPT system's activities, and CAPT system's feedback interpretation.

5.3.1.1 Participants' perceived ease of use of the CAPT system's user interface

Overall, participants in both groups agree that the program's interface was only challenging at the start of the training. Similar to the classroom observation results, they reported facing difficulties in browsing activities and displaying advanced visual feedback at the beginning of the course. It was until the participants had the chance to practice activities with the program that they started to feel more comfortable with using it. This positive influence of practice on participants' PEU is also confirmed by the data from classroom observations (discussed in the previous section). The demand for the teacher's support to resolve technical issues has dropped suddenly once the participants passed the sessions focusing on a single prosody feature to the free practice session. At this point, the participants seemed to have gained more confident in using the CAPT system.

Similar PEU reports obtained from the two training groups point to an important factor of progressive familiarity with the CAPT program. Importantly, this factor seems to also play an important role in increasing learner's autonomy, as suggested by Blin's (2004). Unlike some of the results in previous CAPT literature (e.g. Luo, 2016; Tsai, 2015), where participants practicing collaborative face few and different user issues compared to participants with individual access, the access modes to the technology in the current study did not significantly influence the participants perceptions of navigating the CAPT system's UI. And although participants in the collaborative CAPT group benefited from peer support, and therefore requiring less support from the teacher, they reported facing the same use issues reported in the individual CAPT group. The main difference between the two groups in this regard is that participants in the collaborative CAPT group solved most of the issues in groups, while the individual CAPT group required the teacher.

5.3.1.2 Participants' perceived ease of the CAPT system's audio-visual input

Overall, the participants in the two training groups reported that the Audio-visual input provided by the CAPT system was easy to understand. Almost all of the participants reported that the native speech models they received from the CAPT system while practicing the prosody features were comprehensible. This could be a direct result of the compatibility between the general language proficiency level of participants (low-intermediate) and the language level of the chosen sentence pronunciation activities from the CAPT system during the intervention (low-intermediate) (see **Appendix 4**, Sentences practiced during the training sessions). Moreover, the positive PEU reports could also be a result of the flexible style in which prosodic input is presented by ASR based CAPT systems like "Tell Me More". Such perceived flexibility, as also found in Hsu (2016), allows participants to play, pause, and replay the speech models giving them more time to listen to and understand them. Moreover, and as Neri, Cucchiarini, Strik, et al. (2002) highlight, this positive PEU of CAPT's input could also be due to the various ASR based CAPT speech visualization features such as subtitles, images, soundwaves, and mouth representations that facilitated the understanding of the speech models of sentences. These features acted as a supplementary resource for participants in cases where the audio model was not comprehensible.

5.3.1.3 Participants' perceived ease of practice with the CAPT system's activities

Participants' perceptions toward activities were also similar as they reported similar positive and negative issues. According to the participants from the two training groups, the activities were straight forwards and easy to use. However, the speech recognition failures made the activities a little bit challenging to complete. The positive perceptions can be attributed to the simple nature of

the “listen and repeat” and the “listen and choose the correct answer” activities of the CAPT system. In line with the findings of Yu et al. (2016), where EFL students in China found “listen and repeat” and “listen and choose the correct answer” activities in CAPT systems easy to use, Algerian EFL students in the current study found them simple. This simplicity was especially reported as it helped the participants to focus on the use of prosody features instead of the difficulty of the activities. On the other hand, the speech recognition issues, as pointed out in Neri, Cucchiarini, and Strik (2002), contributed to participants’ negative PEU evaluation of the program. In many instances, the participants from the two training groups had to repeat well pronounced sentences because the program was not able to detect them. This issue was strongly emphasized by the participants, as the speech recognition process was directly related to the feedback generated by the program. This issue interrupted participants’ practice and, sometimes, provided them with a false impression that their pronunciation output was not comprehensible; thus, resulting in their need for the teacher’s feedback.

The difference in PEU reports between the collaborative CAPT group and individual CAPT group was, however, particularly clear when participants referred to their general impression of the practice process itself. While the participants in the collaborative CAPT group found the practice with CAPT activities to be fun and engaging, their counterparts in the individual CAPT group found it to be repetitive and mechanical. Similar to the perception results generated in Tsai (2015) and Chiu et al. (2007), such PEU reports in the individual CAPT group can be the result of the activities design in CAPT and absence of peer interaction similar to that of the collaborative CAPT group. Generally, the design of CAPT programs offers a limited variety of pronunciation activities most of which rely on listening and repeating or choosing the correct answer (Neri, Cucchiarini, & Strik, 2002). Thus, such lack of variety, as criticized in Yoshida (2016), can start to feel monotonous especially considering the longer exposure time to CAPT that participants in the individual CAPT group enjoyed. Moreover, this difference in PEU reports regarding the nature of practice can be attributed to the lack of peer interaction which was only available in the collaborative CAPT group. Such an interpretation is in accordance with the expectations and results of Peiya (2002) and Warschauer (1996) respectively. While the participants in the collaborative CAPT group benefited from social interaction, that tackled technical, linguistic, and psychological issues, their counterparts were mostly exposed to the CAPT program with limited interaction with the teacher. This has resulted in social engagement in the collaborative CAPT group that, through its emotional interaction (as evidenced in classroom observation), motivated participants and engaged them. Meanwhile, the lack of social interaction in the individual CAPT group made participants feel that

they are engaged in a repetitive and monotonous practice that lacked genuine emotional interactions.

5.3.1.4 Participants' perceived ease of the CAPT system's feedback interpretation

The feedback generated by the CAPT system was perceived very positively by the participants from both groups, individual and collaborative. According to participants' reports, the speech visualization features representing prosody features were "intuitive"; that is, very clear to interpret. Similar to the findings of Hardison (2004), the participants in both the individual and collaborative CAPT groups found the feedback easy to interpret, especially the feedback on their intonation as the blue pitch contour in "Tell Me More" stood out in representing intonation. Furthermore, and with fewer positive reports, the PEU results of the present study revealed that participants in the two training groups found the word and sentence stress visual representation through the amplitude of soundwaves easy to interpret and understand. Importantly, though, and similar to the results of Tanner and Landon (2009)'s study, the ease of interpreting stress feedback depended on the difficulty of speech models in terms of listening as well as the visual representation. In some examples, participants found it difficult to differentiate between content words and function words due to the unclarity of the model's pronunciation and wave amplitude. It is important to note that participants' positive perceptions about the CAPT system's feedback are very likely to be the result of introducing speech visualization features to participants before the start of the training. This is in line with the recommendations of Anderson-Hsieh (1994) and Hansen (2006) who advocated for familiarizing students with the speech visualization features for a more rewarding training experience.

A few negative PEU comments on feedback were on scoring students' output. On multiple occasions, the participants of the two training groups reported that they found the scores a little bit confusing as they felt that they didn't reflect their performance. Such negative PEU mentions, as discussed in the previous technical CAPT literature (e.g. Cardeñoso-Payo, Ferreras, & Mancebo, 2014; Strik et al., 2009), can originate from the speech recognition failures which resulted in misguided feedback. This has caused confusion among the participants when trying to interpret feedback as they had to repeat comprehensible pronunciation output multiple times. This has especially influenced participants' PEU negatively since CAPT scores, as in the case of "Tell Me More", are usually a number. According to Hansen's (2006) proposed criteria for CAPT feedback, such scores are not comprehensible, as they do not accurately highlight the pronunciation mistake

or error, and are not corrective, as they do not provide guidance for the student to help them work on their pronunciation problems.

5.3.2 Participants' perceptions towards the usefulness of collaborative and individual CAPT of prosody

Despite the differences found between the PEU reports of the two groups, the PU reports were generally similarly positive. The two training groups appreciated the amount and quality of input provided by the CAPT system, the opportunities to practice prosody features, and the positive role of the speech visualization features. The PU results of the current study come in line with the perception results of the previous studies highlighting the advantages and disadvantages of individual as well as collaborative CAPT (e.g. Hardison, 2004; Hsu, 2016; Tsai, 2015, 2019). The following sections interpret and discuss participants' PU reports about input, practice, and feedback in more detail.

5.3.2.1 Participants' perceived usefulness of the CAPT system's audio-visual input

Overall, the PU reports from the two training groups indicated participants' appreciation of the amount and quality of the audio-visual input provided by the CAPT system. Although the participants in the collaborative CAPT group provided a slightly higher frequency of positive mentions about input (6 positive PU mentions) than their counterparts in the individual CAPT group (5 positive PU mentions), they equally highlighted the usefulness of input in illustrating prosody features and their use. These results do meet the promise of CAPT technology, as highlighted in Pennington (1999), to provide an amount and quality of input to raise participants' awareness of prosody features. In the case of the current study, this was particularly useful for Algerian EFL students who, as Miliani (2001) highlights, do not receive enough exposure to pronunciation input in the target language inside and outside of the classroom.

The PU mentions in the two training groups, however, did not show significant differences that would highlight a possible perceived influence of the access mode (collaborative or individual). Therefore, it is suggested that the participants under both the collaborative and individual training conditions perceived CAPT input to be equally beneficial (although slight differences were detected through observation). This comes in agreement with previous studies investigating students' perceptions towards collaborative and individual CAPT and addressing their attitudes towards input (e.g.Tanner & Landon, 2009; Tsai, 2015). For example, as evidenced by Tsai (2015), while collaborative access to CAPT can facilitate the exposure process to input, it does not radically

influence its perceived usefulness. This is mainly because CAPT technologies offer participates with self-access to CAPT the option of playing and replaying audio input as well as speech visualization. Such features, therefore, influenced the PU reports of participants in the individual CAPT group about input positively.

5.3.2.2 Participants' perceived usefulness of the CAPT system's activities

The PU reports in the two training groups also showed participants' appreciation for the practice opportunities offered by the CAPT system. Both groups found the variety of sentences useful as it allowed them to practice different types of sentences and, as a result, different uses of the practiced prosody features during the training sessions. Unlike the limitation observed in some CAPT platforms (Neri, Cucchiarini, Strik, et al., 2002), the learning program used in the current study (Tell Me More) was perceived by students to have a decent variety of declarative, interrogative, imperative, and exclamatory sentences that allowed for a diverse use of prosody features. The importance of input variety and its positive influence on students' perceived effective practice is also emphasized in the CAPT literature (Pennington, 1999).

Some negative PU perceptions about the CAPT system's activities were similarly found in the reports of the two training groups. Students' negative PU perceptions of activities were mainly expressed in terms of speech recognition failures. As discussed in the PEU reports of the CAPT system's activities, the participants found themselves repeating sentences that were pronounced properly and missed opportunities to practice more challenging sentences. This, in turn, made students feel that they lost valuable practice time. Such results are in line with the expectations of Neri, Cucchiarini, Strik, et al. (2002) about the inconsistent ASR performance and the frustrating effect it can have on students' perceptions toward the usefulness of the technology.

5.3.2.3 Participants' perceived usefulness of the CAPT system's feedback

Along with the positive PU views about audio-visual input and activities, the reported PU perceptions about feedback were also positive showing an appreciation for the useful role of the speech visualization features in highlighting and correcting their pronunciation mistakes. This finding is also evident in the previous studies addressing EFL students' perceptions towards the usefulness of feedback when practicing prosody features with CAPT technology (e.g. Chiu et al., 2007; T. Lee, 2008; Stenson et al., 1992; Tsai, 2015). Furthermore, theoretically, these results are in line with the expectations of Anderson-Hsieh (1992) about employing the visual features of ASR based CAPT practicing prosody features. The participants of the two training groups found the

representation of the correct models immediately after their pronunciation attempts to be useful as it provided guidance for them. This served as a recast, a form of feedback in which the teacher repeats a student's output in the correct form (Y. Sheen, 2006), and helped in raising participants' awareness of the use of prosody features. This, as famously suggested by Schmidt (1992) in his noticing hypothesis and emphasized by Long (1996), might have helped the participants in correcting their pronunciation mistakes as they followed different models.

The PU reports of the participants in the two training groups also addressed the usefulness of the red highlighting of pronunciation mistakes. However, participants' understanding of how to make the most use of this feature was limited. While the two training groups positively perceived the highlighting of syllable and sentence stress mistakes, such a visual feedback feature was not similarly positively referenced in participants' PU reports when it comes to intonation mistakes. Such reservations about the usefulness of the red highlighting feature in participants' reports could be due to the technical limitations in the CAPT system, especially those related to speech recognition. As pointed out by O. Engwall et al. (2006) and Levis (2007) at the current technological level, the ASR based CAPT is usually more effective in detecting segmental mistakes than suprasegmental mistakes. It is also interesting to note here that the participants in the collaborative CAPT group expressed more positive PU perceptions about the highlighting of errors than their counterparts in the individual CAPT group. While the difference in positive PU mentions is not significant, it is likely that the negotiation of meaning that took place between the participants practicing collaboratively helped them in interpreting and understanding feedback. This finding is also in agreement with the recommendations of Anderson-Hsieh (1994) and the results of Tsai (2015) emphasizing the important role of teacher or peer guidance in interpreting the immediate visual feedback provided by CAPT programs. In the case of pronunciation practice, human interaction is more likely to provide clearer recast. For example, in the case of unclear audio or visual emphasis on a word stress in CAPT, a peer is capable of repeating a sentence illustrating the use of emphasis on content words.

One aspect of feedback that was perceived negatively by the participants of the two training groups was the scoring system of the CAPT program. All of the participants found the scoring feature of feedback the least useful characteristic in the CAPT system. According to their reports, this feature was confusing as they often felt that it did not reflect their pronunciation quality. A possible reason for this issue, as discussed in Hansen (2006), could be due to the lack of a corrective feature in the generated scores. In the automatic scoring system, CAPT programs rely on a

mathematical comparison between the output of the student and the output of the speech model (S. M. Witt & Young, 2000) (see **Chapter 2**, Section 2.3.1 The technical architecture of ASR based CAPT systems). Unlike the corrective features of feedback, which included speech visualization and audio models, the numerical scores did not serve a useful purpose for the participants' practice. It is worth noting that the participants in the collaborative CAPT group provided slightly more negative PU reports about the automatically generated scores (three negative PU mentions) than their peers in the individual CAPT group (one negative PU mention). This could well be due to the participants feeling more pressure when receiving scores on their output in front of their peers compared to the participants in the individual CAPT group. The automatically generated scores, and similar to the broad feedback often provided in the traditional language classroom (Neri, Cucchiarini, Strik, et al., 2002), made the participants in the collaborative CAPT group feel judged about their output. On the other hand, the participants in the individual CAPT group, and while they found the score confusing, they did not have similar social pressure.

Chapter Six: Conclusion, Contribution, Limitations, and Recommendations

This final chapter presents the general conclusion of the study, its contribution, pedagogical implications, methodological limitations, and provides a set of recommendations for future research. The chapter is divided into three main sections. The first section provides general conclusions for the three main research questions of the current study to address the overall aim of exploring collaborative CAPT of prosody. The second section details the contribution of the current study to the knowledge about CAPT and highlights the pedagogical implications derived from it. Finally, the third section points out the methodological limitations that the current study faced and provides a set of recommendations for future research to avoid them.

6.1 General Conclusion

Overall, the premise of advantageous collaborative CAPT of prosody practice with Algerian adult EFL learners was only highlighted through the qualitative results. While the read-aloud test results assessing participants' prosodic quality and overall pronunciation comprehensibility did not show significant learning development, the results of classroom observation and participants' perception reports showed that collaborative CAPT of prosody created an independent training environment that was perceived by participants as exciting and engaging as opposed to an individual training environment that was teacher dependent and perceived by participants as monotonous and repetitive. A very likely explanation for the lack of significant pronunciation learning development is the limited practice time (6 hours) dedicated to the current study. Despite that, the qualitative tools generated interesting insight about the advantages and challenges of collaborative and individual CAPT of prosody. Such insights could help guide the Algerian EFL teachers (and EFL teachers in similar contexts) who intend to employ CAPT in their EFL classroom. The following three sections attempt to summarize the results and discussion to provide a comprehensive response for each of the three main research questions addressed in the current thesis.

6.1.1 Conclusion for research question No.1

To what extent does collaborative CAPT of prosody features enhance Algerian EFL learners' pronunciation learning?

No significant pronunciation learning differences were found between the groups of the study. Although both training groups achieved small development in their use of prosody features

(namely syllable stress, sentence stress, and intonation), such progress did not significantly influence EFL participants' overall comprehensibility. The lack of significant pronunciation learning results is very likely due to the limited duration of the study. This interpretation is in line with the CAPT literature highlighting the crucial role of training duration in helping EFL students to first develop their perception of prosody and then work on their pronunciation production (e.g. Hardison, 2004; Luo, 2016; Seferoğlu, 2005; Tanner & Landon, 2009). Moreover, a possible reason for the lack of significant developments in participants' overall comprehensibility is the lack of focus on phonemic features in this study which primarily addressed collaborative CAPT of prosody. This explanation is particularly likely when considering the EFL pronunciation literature emphasizing the role of phonemic features along with prosody features for EFL students to achieve comprehensible or intelligible pronunciation (Munro & Derwing, 1995; Saito et al., 2016).

In terms of the small prosodic gains achieved by the training groups, the individual CAPT group achieved slightly better learning results than the collaborative CAPT group. Although insignificant, such results could be explained by the longer exposure time offered by the individual access mode to the CAPT technology. This interpretation is in line with the previous CAPT literature investigating the influence of individual and collaborative CAPT where self-access groups often achieved better pronunciation learning results than their counterparts in the collaborative groups (pairs or groups) (e.g. Elimat & AbuSeileek, 2014; Tsai, 2015). This is mainly due to exposure time which allows participants in the individual CAPT group to receive more input, practice their pronunciation at their own pace, and receive more personalized feedback. On the other hand, the participants in collaborative CAPT groups have to sacrifice those crucial features to grant equal practice time for them and their peers.

6.1.2 Conclusion for research question No.2

To what extent does collaborative CAPT of prosody influence Algerian EFL students' required guidance to practice in comparison with individual exposure to the technology?

EFL students working in pairs required significantly less technical and non-technical support from the teacher. In compatibility with the literature discussed for the theoretical framework of the current study (e.g. Beatty, 2013; Bitchener, 2004; Jeon-Ellis et al., 2005; L. Jones, 2006; Warschauer, 1997), the participants practicing collaboratively at the computer sought help from each other before seeking the support from the teacher. This has led the participants in this group to take responsibility in managing their own practice, mostly rely on each other to resolve the

technical issues related to the use of the CAPT program, engage in negotiation of meaning to discuss prosody features and their use, and provide emotional support. This, thus, has led to a social practice environment with minimal reliance on the teacher. On the other hand, the participants in the individual CAPT group seemed to be overly dependent on the teacher despite having self-access to the CAPT program. The participants in this group required significantly more interventions from the teacher to provide technical support for the use and function of the CAPT program and elaborate on the CAPT program instruction and representation of prosody. Despite having the advantage of longer exposure to the CAPT program, the participants in this group lacked an immediate genuine social interaction, as recommended in Anderson-Hsieh (1994), to facilitate their technical, linguistic, and motivational challenges with the technology.

6.1.3 Conclusion for research question No.3

How do Algerian EFL students perceive of collaborative and individual CAPT of prosody features?

As for the perception results, participants in the two groups provided a high frequency of positive perceived ease of use (PEU) and perceived usefulness (PU) reports about the learning program's input, activities, and feedback. Such positive results came in agreement with the previous CAPT literature investigating EFL students' perceptions about CAPT's prosodic input (e.g. Tanner & Landon, 2009), its self-paced training (e.g. Pennington, 1999), and immediate personalized feedback (e.g. Anderson-Hsieh, 1994). However, one aspect of the training that both groups did disagree on is their PEU of practice in CAPT's activities. While the participants in the collaborative CAPT group found it to be fun and engaging, their peers in the individual CAPT group found it monotonous and repetitive. Such outcomes echoed the results of Tsai (2006, 2015) and Chiu et al. (2007) highlighting the role of the mode of access to such technology. In this study, the difference in the results was primarily attributed to the role of the student-student support interactions that took place in the collaborative CAPT group and was missing in the individual CAPT group. Such social interaction, in accordance with the suggestions of Long (1996) and Pica (1994), and the evidence found by L. Jones (2006), allowed for negotiation of meaning to tackle issues related to the input being received, overcome practice challenges, and ease the process of interpreting CAPT's automatic feedback. This has consequently given the participants in the collaborative CAPT group an impression of easy and useful practice. Meanwhile, the lack of similar social interaction in the individual CAPT group led to an impression of a long mechanical pronunciation practice that felt very repetitive.

6.2 Contribution and Implications of the Study

6.2.1 Contribution of the study

The current study generated valuable insights about the extent to which collaborative CAPT of prosody can address the limitations facing prosody instruction and practice in the Algerian EFL classroom. The systematic literature review showed that the majority of studies exploring CAPT of prosody were conducted in EFL and ESL contexts that were linguistically and pedagogically different from the Algerian EFL context (e.g. Chiu et al., 2007; Elimat & AbuSeileek, 2014; Hardison, 2004; Tanner & Landon, 2009; Tsai, 2015, 2019). Moreover, most of these studies took an individualistic approach that resulted in technical, linguistic, and motivational challenges for the engaged EFL students (e.g. Chiu et al., 2007; Hardison, 2004; Tanner & Landon, 2009). To address such gaps in the research literature, the current study suggested a sociocultural inspired collaborative CAPT of prosody features with Algerian EFL learners. Such approach, and based on evidence in collaborative CALL studies (e.g. Ewing, 2000; Jeon-Ellis et al., 2005; L. Jones, 2006; Warschauer, 1996), has the potential to help students in tackling the technical, linguistic, and psychological challenges faced in the individualistic CAPT studies. This approach was especially proposed to address the limitations of prosody instruction in an Algerian EFL classroom where pronunciation instruction is primarily focused on the perception and production of phonemes through phonetic transcription activities (Fethi, 2016; Sonia & Abdelkader Lotfi, 2016b). Meanwhile, prosody features are often neglected due to the lack of specialized teacher training and practice materials (Fethi, 2016). This is in spite of the evidence highlighting the equal value of such prosody features for EFL pronunciation comprehensibility (Munro & Derwing, 1995; Saito et al., 2016), a pronunciation quality that is highly required from Algerian EFL graduates in jobs where oral communication is necessary (Belmihoub, 2017). Collaborative CAPT, therefore, was seen as a novel approach for Algerian EFL learners to practice prosody while fully benefiting from the technology's prosodic input, activities, and feedback without facing the technical, linguistic, or motivational challenges of individual CAPT.

Employing a mixed-method approach, the current study provided interesting insights about collaborative and individual CAPT of prosody with Algerian EFL students. Based on the review of the literature, the majority of studies on individual (e.g. Jolley, 2014; Liu & Hung, 2016; Ramírez Verdugo, 2006; Tanner & Landon, 2009; Yenkimaleki & van Heuven, 2019) and collaborative (e.g. Elimat & AbuSeileek, 2014) CAPT of prosody with EFL learners employed a predominantly quantitative approach that focused primarily on generating pronunciation learning results with little

attention to the learning process. To address this gap, the current study employed a concurrent embedded mixed-method strategy to data collection that not only allowed for the measurement of pronunciation learning results, but also provided insights about the practice process and systematically assessed participants' perceptions. Participants' pronunciation learning was assessed based on read-aloud tests that were conducted before and after the study and evaluated in terms of prosodic quality through expert coding, as in (Saito et al., 2019), and in terms of overall pronunciation comprehensibility through scalar ratings by nine expert and non-expert listeners as in (Munro & Derwing, 1995). In its qualitative dimension, and while the research literature mainly used questionnaires and learning logs to generate insights about CAPT of prosody based on EFL students' reports (e.g. Chiu et al., 2007; Hardison, 2004; Tanner & Landon, 2009; Tsai, 2006), the current study employed camera and screen recordings in a novel approach to directly observe the collaborative and individual CAPT of prosody. Such data collection tools helped in shedding light on the extent to which collaborative versus individual CAPT of prosody help participants in tackling their practice challenges based on the results of the required technical and non-technical assistance instances provided by the teacher during the training. Moreover, and while the previous studies employed questionnaires and learning logs to generate general information about EFL learners' perceptions toward collaborative and individual CAPT of prosody (e.g. Tsai, 2015; Tsai, 2019), the current study employed the technology acceptance model (TAM) to systematically collect and analyze Algerian EFL learners' perceived ease of use and usefulness of such access modes to practice prosody features with CAPT technology. This allowed in generating interesting insights about the ways in which collaborative and individual CAPT of prosody affect Algerian EFL learners' perceived ease of use and usefulness of the technology's audio-visual input, pronunciation activities, and the immediate personalized feedback.

6.2.2 Pedagogical implications

Based on the findings of the current study, this section provides a set of pedagogical implications for Algerian EFL teachers and EFL teachers in similar linguistic and educational contexts intending to implement ASR based CAPT technologies with their students. As per the recommendations of Bouchefra and Baghoussi (2017), the introduction of CALL technologies in the Algerian EFL context alone without pedagogical guidelines for teachers to properly implement them is not enough to address the limitations faced by students. Since the current study explored the collaborative and individual access modes to CAPT, the pedagogical implications focus on the potential advantages and disadvantages of each access mode to the technology. This can give teachers an idea about the

expected benefits and challenges from their implementation of CAPT under each access mode based on the amount of time and resources available for the teacher and their students' learning styles.

Given the findings of the current study, teachers planning to employ CAPT can expect advantages and challenges under both collaborative and individual access modes to the technology. Implementing CAPT through an individual access mode offers extended periods of practice for EFL students. This is mainly because students engaging in individual CAPT are not sharing their time with the technology and features. Therefore, this gives them a greater potential to benefit from the unlimited audio-visual input, self-paced practice, and personalized immediate feedback offered by the ASR based CAPT system in a lesser amount of time than the collaborative access mode. In terms of prosody practice through sentence pronunciation activities, as investigated in the current study, this means longer exposure to the audio speech recordings and their visual representations of syllable stress, sentence stress, and intonation. Such exposure to the audio-visual input is very likely to increase EFL students' awareness of prosody features and influence their pronunciation production positively (Tanner & Landon, 2009). Additionally, the individual access to CAPT allows students to fully benefit from the self-paced and the immediate personalized feedback practice feature in ASR based CAPT technologies. This, as demonstrated in Hincks and Edlund (2009) and Hincks (2003), gives EFL students more chances to recognize their sentence pronunciation problems through the audio-visual feedback and allows students to work on them on their own pace.

Teachers, however, should also take into consideration some of the challenges that can arise from individual access to CAPT. First, individual CAPT requires more resources than collaborative CAPT as each student is expected to work alone with one computer device with the ASR based CAPT program. This is particularly important to consider for Algerian EFL university programs that intend to employ CAPT technologies but, as pointed out by Daghbouche (2011), still face financial and resource constraints. There is also a higher likelihood for EFL students engaging in individual CAPT of prosody features to face technical and non-technical challenges as evidenced by the classroom observation results in the current study. The technical support can be mostly related to the use of the CAPT system and resolving issues related to the functioning of the software and hardware of the technology. As for the non-technical support, it can include students' inquiries about the CAPT tasks, their objectives, and support with the interpretation of the automated immediate feedback. Teachers, therefore, are expected to familiarize themselves with the CAPT

technology and its feature to practice prosody so that they can provide sufficient support for their students (Anderson-Hsieh, 1992). Moreover, individual CAPT, and while it is very likely that it would be perceived positively by EFL students in terms of its use and usefulness to practicing prosody, it can also be perceived as repetitive. Given that EFL students engaged in individual CAPT would benefit from extended periods of practice time with the CAPT system, they can start to perceive it as monotonous due to the nature of ASR based CAPT activities (mainly "listen & repeat" activities) and lack of social interaction. In such situation, the teacher can either diversify the types of CAPT activities proposed for their EFL students (e.g. between "listen & repeat" and "listen & choose the correct answer") or only recommend practice with such technology to serve particular sentence pronunciation teaching goals (e.g. raising students' awareness of sentence stress).

On the other hand, collaborative access to CAPT, while it did not achieve significant learning results in the current study, can offer a number of practice advantages for EFL students when dealing with sentence pronunciation. In terms of resources, collaborative CAPT can be considered as a relatively cheaper access mode to CAPT technology than the individual access mode. Such access mode, to address the financial issue discussed in Daghbouche (2011), can be advantageous for Algerian EFL university programs that intend to employ CAPT but possess limited computer resources. Moreover, collaborative CAPT of prosody is more likely to produce an independent practice environment. In collaborative CAPT, as found in the current study, students are more likely to require support from the teacher. With the exception of an introduction to the technology and how it is used for prosody practice, the collaborative setup encourages students to engage in peer support for their technical and non-technical issues (Ewing, 2000; Jeon-Ellis et al., 2005; Warschauer, 1996). As found in the current study, this peer support (represented in S-S support interaction observation) can include 1) technical support that is very likely to be dedicated for overcoming issues related to the use of the technology, 2) an important number of negotiation of meaning instances through which students can discuss prosody features and their use, and also 3) spontaneous informal social interaction that can play an important role in motivating students during practice. Such collaboration, if it arises, can influence EFL students' perception toward the CAPT technology positively. Under such access mode to CAPT, students are more likely to find the technology easy to use and useful for their learning.

When employing such collaborative access mode to CAPT of prosody, however, EFL teachers are advised to expect some challenges facing students. The main challenge that could be

noticed when EFL students engage in collaborative CAPT of prosody is that noticeable pronunciation learning results can take extended periods of time for them to be achieved. This is because collaborative CAPT requires sharing the time with the technology's input, opportunities to practice output, and exposure to feedback. In the current study, this was observed in the limited pronunciation learning gains of participants in the collaborative CAPT group as measured by their prosodic quality and overall comprehensibility. This was very likely a result of the limited exposure to CAPT offered by both the length of the study and the nature of the shared collaborative practice. Therefore, if EFL teachers plan to employ such access mode in CAPT, it is recommended that they allocate long practice periods to allow for the collaboration benefits to take place in the form of learning.

6.3 Limitations of the Study and Recommendations for Future Research

This section highlights the limitations faced in the current study and attempts to address some of the recommendations for similar future work on CAPT. The current study took a quasi-experimental design to explore six weeks of collaborative CAPT of prosody with 18 Algerian EFL learners. For data collection, the current study employed a mixed-methods approach where the qualitative data constituted a significant part of the study mainly through classroom observation of the training process and the investigation of EFL students' perceptions through learning logs and interviews, while only one main research question addressed participants pronunciation learning results through read-aloud tests. Such design of the study, and while it generated important insights about the advantages and challenges of collaborative and individual CAPT of prosody, it was unable to generate conclusive and generalizable results due pedagogical and technical limitations that negatively affected the sample size and duration of the study, the limited scope of some qualitative data collection tools, and the lack of previous research literature on Algerian EFL pronunciation.

While the current study originally recruited a total of 28 participants, only 18 participants were fully committed to attending the extracurricular CAPT course for six weeks. Meanwhile, four students did not attend any session, and six students dropped out after the first session. Such a small sample size allowed only for conducting descriptive statistics and non-parametric tests on the pronunciation learning results. Consequently, it was very challenging to generalize the quantitative results generated in the current study. This small sample size in the current study can be attributed to the lack of participants' motivation to fully engage in the study and the limited technical resources available at the institution in which the current study took place. It is very likely that dropped participants did not find the CAPT sessions rewarding enough to sacrifice time from their

degree. Another reason behind the dropouts after the first session could also be attributed to the technical limitations. The current study was conducted with a limited number of computer devices and, therefore, many participants (or pairs of participants as is the case with the collaborative CAPT group) who attended the first session had to wait to get the chance to practice with the CAPT system. To overcome such issue, similar research in the future could take the form of action research where the CAPT sessions would be planned and integrated by the teacher into the larger EFL speaking class with consideration to the available technical resources and the teacher would be able to reflect on the effectiveness of the pronunciation practice. This would allow researchers to collect results with a considerably larger sample and participants would not have to sacrifice time from their degree.

The action research format for a CAPT study would also help in avoiding any obstacles that would limit the duration of the intervention as in the current study. Ideally, a quasi-experimental study investigating pronunciation learning would usually require more than six hours of training to generate significant learning results that can be attributed to the intervention (Thomson & Derwing, 2014). The dedicated duration for the training sessions in the current study (autumn term 2016) was, however, under restrictions from the schedule of participants in their formal EFL course. Moreover, by the end of the term, many participants were either working on their assignments or preparing for their winter holidays. This prevented the researcher from offering more training sessions and from conducting a delayed pronunciation learning post-test. Future similar work can avoid such duration limitations if the study is conducted by a researcher within the institution. This would give the researcher more flexibility in scheduling the training sessions and conducting delayed pronunciation learning tests. Such recommendation is particularly important considering the evidence in ASR based CAPT literature showing the important role of practice amount and duration in helping EFL learners achieve significant learning development in their use of prosody and overall comprehensibility (e.g. Elimat & AbuSeileek, 2014; Hincks & Edlund, 2009; Luo, 2016; Tanner & Landon, 2009). This is mainly because the longer EFL learners are exposed to such technology the more they are likely to detect their prosodic pronunciation problems and work on them.

With regard to the qualitative results, and to answer the second research question addressing the amount and type of required support in collaborative versus individual CAPT of prosody, the current study employed classroom observation. With the absence of an assistant researcher to observe the sessions, audio-video recordings were used instead. While such tool allowed for the carful and detailed thematic coding of practice instances thanks to the video pausing

and replaying options (which was later verified by an assistant research), it was difficult to interpret and code some instances in retrospect. Such issue was particularly challenging in instances where interactions took place at a difficult angle of the camera or away from the microphone. To avoid such limitation, future research could rely on both instant human and audio-video recorded classroom observation to further confirm and verify the generated results.

The current study also employed learning logs and interviews to explore EFL participants' perceptions of collaborative and individual CAPT. Such data collection tools were used to answer the third research question that was addressed to investigate the perceived ease of use and usefulness of collaborative and individual CAPT of prosody from EFL students' perspective. The results generated through such tools, and while they provided interesting and in-depth insights on EFL learners' perceptions toward collaborative and individual CAPT of prosody, are still far from conclusive or generalizable. This is primarily because participants did not experience the two modes of access to CAPT simultaneously. Consequently, it can be difficult to assume that the generated reports through learning logs or interviews objectively and conclusively reflect the similarities and differences between collaborative and individual CAPT because participants' answers could be biased towards one mode of access to the technology. Moreover, participants occasionally provided interview comments and learning log reports that lacked depth. This is mainly because most of the participants insisted on using the English language in their reports despite informing them that the interview and learning logs were not tools to evaluate their English language level. Consequently, many participants found it challenging to convey their message clearly and with enough detail in the perception reports. To overcome such limitations, future studies can employ more objective empirical measures to assess EFL students' perceptions of the different modes of access to CAPT.

As far as the context is concerned, the current study attempted to explore collaborative CAPT of prosody with Algerian EFL students in an attempt to address the limitations of prosodic pronunciation instruction in the Algerian EFL classroom. In doing so, the current study found sever scarcity in the Algerian literature on EFL pronunciation. With the exception of some studies highlighting the pedagogical limitations of pronunciation instruction in the Algerian EFL context (e.g. Fethi, 2016; Sonia & Abdelkader Lotfi, 2016a), few studies have addressed the linguistic factors affecting the pronunciation learning of Algerian EFL students. Such studies are particularly needed as they would help future researchers to pinpoint the problematic supra-segmental features for this population of EFL learners especially given the uniqueness and complexity of the Algerian linguistic context (Belmihoub, 2017). Therefore, future research could shed more light on the extent

and the way Algerian EFL students' linguistic background can influence their English pronunciation through empirical studies.

It is also worth noting that the current study was conducted with adult Algerian EFL learners at a university level. Such participants reported having been taught English for at least nine years and that all of them used a CALL technology before for the purpose of learning or practicing the four English skills. Future research can also look at younger EFL students in middle schools and high schools. Such research can yield interesting results on the extent to which CAPT can help Algerian EFL learners' progress in their pronunciation learning throughout different age groups. This is especially important with the increasing availability of portable and desktop computer devices and the use of CALL technologies with the emerging generations of Algerian EFL learners.

Appendices

7.1 Appendix 1. Consent Form

Project title: Exploring the pedagogy of pronunciation training using CAPT technology in the EFL classroom environment
Researcher: Moustafa Amrate
The purpose of the research project is to explore the pedagogy of pronunciation training using CAPT technology in the EFL classroom environment
Research methods: Classroom observation, learning logs, questionnaires, interviews and pronunciation tests (Audio recorded read aloud activity).

Please read carefully and then complete the consent form in the next page.
Role of the participants: sixteen EFL students will be recruited randomly from the course you are teaching to take part in a study that is exploring the pedagogy of using computer assisted pronunciation training (or CAPT) technology in the speaking class to practice prosody. The study will consist of seven speaking sessions in which the teacher/ researcher will be using the CAPT technology MyET to teach the three sentence pronunciation features, namely: stress, rhythm and intonation. Participants will be divided into two groups, a main group in which students will be receiving the training under collaborative conditions and a control group receiving training individually. Before the training starts, participants will be asked to take a pronunciation test and complete a questionnaire that will assess their attitudes towards computer assisted pronunciation training. During the training, the sessions will be audio visually recorded for the purpose of classroom observation. Students will also be asked to write a one paragraph learning logs. By the end of the training, participants will take another pronunciation test and complete a post-study questionnaire that will attempt to explore their perceptions of pronunciation training using the CAPT technology MyET in a classroom environment. Moreover, six participants will be chosen to take part in a post-study interviews that will address learners' perception towards this training through even more open questions. Participants will be able to request and comment on a transcribed copy of their interviews

N.B. Students participation in this study is voluntary as they can withdraw from it at any time up to the second session of the training. Students will also have the right to withdraw their participation within two weeks after the study. If they do so, any data that they provide will be destroyed.

Recompense: in return for their effort of taking part in this study, participants will receive incentives worth up to 200 DZD by the end of the training. Receiving this financial recompense will mainly depend on participants' commitment to attend all of the training sessions and taking part of all the data collecting processes.

Anonymity and confidentiality: All the information participants provide will be encoded into the format of letters and numbers and therefore they will not be identified as individuals in the final research or other types of academic work based on these data. The encoding process will take place within seven days after the data collection.

Storing and using your data: The collected data will be securely stored in locked files within an external hard drive and only the researcher will be able to access the data. The data will be used as a part of the PhD thesis and research publications. After that, the results will be archived and it may be used for future research purposes. If participants do not want their data to be used as a result of this research, they will have all the freedom not sign this form or take part in this study.

In case you want to ask about further information concerning the research and students' involvement in the study please do not hesitate to get in touch with the researcher through the following contact details:
Researcher: ma1106@york.ac.uk
For queries, concerns and complaints please contact:
Education Ethics Committee: education-research-administrator@york.ac.uk

Thank you for taking time to read this information.
Yours sincerely
Moustafa Amrate

The following statements establishes that you have read and understood what taking part in this research study will involve. Please tick the boxes that apply.

1- I confirm that I have read and understood the nature of the study in which students in my institution will take part. ☐

2- I confirm that I have read and understood the role of participants in this study. ☐

3- I understand that students' participation in this study is voluntary and that they are free to withdraw before the second sessions without giving specific reasons. ☐

4- I understand that students can withdraw their participation in this study for up to two weeks after the training sessions. ☐

5- I understand that withdrawing from the study means that any data participants provided will be destroyed. ☐

6- I understand that students will have the right to request and comment on the written transcript of the interviews recorded with them. ☐

7- I understand that the data students provide will be securely stored. ☐

8- I understand that the data will be security archived for the purpose of future research work. ☐

9- I understand that any information students provide will be dealt with anonymously and that they will not be identified as an individual in the final thesis or any sort of publications. ☐

10- I confirm that I have had the opportunity to ask questions. ☐

11- I give the permission for the researcher to recruit participants. ☐

Full name: ..... **Signature:**.....

Date: ..... **Contact detail:** .....

Thank you!

7.2 Appendix 2. Planning of the Training Sessions

7.2.1 Session one

<table>
<tr><td colspan="2">Introduction to CAPT of prosody</td><td>Duration: 60 minutes</td><td colspan="2">Number of the session: 01</td></tr>
<tr><td colspan="5">Aim(s):
• To make students able to practice their pronunciation using Tell Me More.
Objective:
• By the end of this session, students will learn about the language learning program Tell Me More and how it is used for pronunciation training.</td></tr>
<tr><td>Timing</td><td>Activity</td><td>Student Activity</td><td>Aim of the activity</td><td>Resources needed</td></tr>
<tr><td>15 minutes</td><td>General introduction to computer assisted pronunciation training (CAPT)</td><td>N/A</td><td>To introduce CAPT in general & explain the processes involved in this technology proving concrete examples of the technology</td><td>- PPT slides</td></tr>
<tr><td>15 minutes</td><td>Introduction to the language learning technology “Tell Me More”</td><td>N/A</td><td>To introduce the language learning program used in this study “Tell Me More”, its interface and how to access the different activities</td><td>- PPT slides
- Tell Me More software</td></tr>
<tr><td>30 minutes</td><td>CAPT training “Setting the table”</td><td>Students will use Tell Me More to practice their English pronunciation</td><td>To make EFL students have their first encounter with the software and practice the different activities offered by the program</td><td>- 6 computers
- The language learning program Tell Me More
- Headsets</td></tr>
</table>

7.2.2 Session two

Word stress in CAPT	**Duration:** 60 minutes	**Number of the session:** 02

Objective:

- By the end of this session, students will have the opportunity to practice word stress through both traditional authentic interaction activities and through CAPT technology using Tell Me More.

Timing	**Activity**	**Student Activity**	**Aim of the activity**	**Resources needed**
5 minutes	Introduction to stress in English pronunciation	N/A	To introduce/ refresh students' memory about stress in English pronunciation	- PPT slides
10 minutes	Listening activity	Students will hear different utterances and words and will be asked to highlight the stressed syllables	To raise students' awareness of stress and its influence on meaning in English pronunciation	- Mp3 recordings
15 minutes	Introduction to word stress (syllable) training using the CAPT system Tell Me More	Students will use the CAPT technology Tell Me More to practice word stress	To make students able to practice and assess their own use of word stress through in the CAPT platform	- PPT slides - Tell Me More software
30 minutes	Word stress training with the sentence pronunciation activity "Window-shopping" in the CAPT system Tell Me More	Students will use the CAPT technology Tell Me More to practice word stress	To give students opportunity to practice word stress using CAPT	- Tell Me More software

7.2.3 Session three

Intonation in CAPT	**Duration:** 60 minutes	**Number of the session:** 03

Objective:

- By the end of this session, students are expected to understand the role of intonation in conveying the message in English

Timing	**Activity**	**Student Activity**	**Aim of the activity**	**Resources needed**
5 minutes	Introduction to intonation in English pronunciation (Warming up phase)	Students will listen to different recordings with different intonation and are asked to note the difference	To introduce/ refresh students' memory about intonation	- PPT slides
10 minutes	Listening activity	Students will listen to different sentences and indicate the direction of intonation	To raise students' awareness of the role of intonation and its influence on meaning in English pronunciation	- Mp3 recordings
15 minutes	Introduction to practicing intonation with CAPT	Students will use Tell Me More to practice their English intonation	To explain to students how to practice and assess their intonation automatically in CAPT	- PPT slides - Tell Me More software
30 minutes	Intonation training with the sentence pronunciation activity "At the airport" in the CAPT system Tell Me More	Students will use Tell Me More to practice their English intonation	To give students opportunity to practice intonation using CAPT	- Tell Me More software

7.2.4 Session four

Sentence stress in CAPT	**Duration:** 60 minutes			**Number of the session:** 04
Objective: • By the end of this session, students will understand the role of sentence stress in addressing the meaning in the English language				
Timing	**Activity**	**Student Activity**	**Aim of the activity**	**Resources needed**
5 minutes	Introduction to sentence stress in English pronunciation (Warming up phase)	N-A	To introduce and refresh students' memory about sentence stress and its role in English pronunciation	- PPT slides
10 minutes	Listening activity	Students will listen to three different recordings of sentences and will be asked to highlight the words	To raise students' awareness of sentence stress	- PPT slides - MP3 recordings
15 minutes	Introduction to sentence stress practice in CAPT	Students will use Tell Me More to practice sentence stress	To explain to students how to practice and assess their use of sentence stress using the CAPT software Tell Me More	- Tell Me More software - PPT slides
30 minutes	Sentence pronunciation training using the CAPT platform Tell Me More "Going on holiday"	Students will use Tell Me More to practice sentence stress	To give students opportunity to practice sentence stress in CAPT	- Tell Me More software

7.2.5 Session five

<table>
<tr><td colspan="2">Overall prosody practice</td><td>Duration: 60 minutes</td><td colspan="2">Number of the session: 05</td></tr>
<tr><td colspan="5">Objective:
By the end of this session students will have had the chance to practice the three prosody features simultaneously through listen and repeat and listen and choose the correct answer activities in the ASR based CAPT system Tell Me More.</td></tr>
<tr><td>Timing</td><td>Activity</td><td>Student Activity</td><td>Aim of the activity</td><td>Resources needed</td></tr>
<tr><td>30 minutes</td><td>Sentence pronunciation training using the “listen and repeat” activity “Diving” with the CAPT platform Tell Me More</td><td>Students will use Tell Me More to practice sentence pronunciation</td><td>To give students opportunity to practice prosody features using an ASR based CAPT system</td><td>- Tell Me More software</td></tr>
<tr><td>30 minutes</td><td>Sentence pronunciation training using the “listen and choose the correct answer” activity “Diving” with the CAPT platform Tell Me More</td><td>Students will use Tell Me More to practice sentence pronunciation</td><td>To give students opportunity to practice prosody features using an ASR based CAPT system</td><td>- Tell Me More software</td></tr>
</table>

7.2.6 Session six

Overall prosody practice	**Duration:** 60 minutes	**Number of the session:** 06

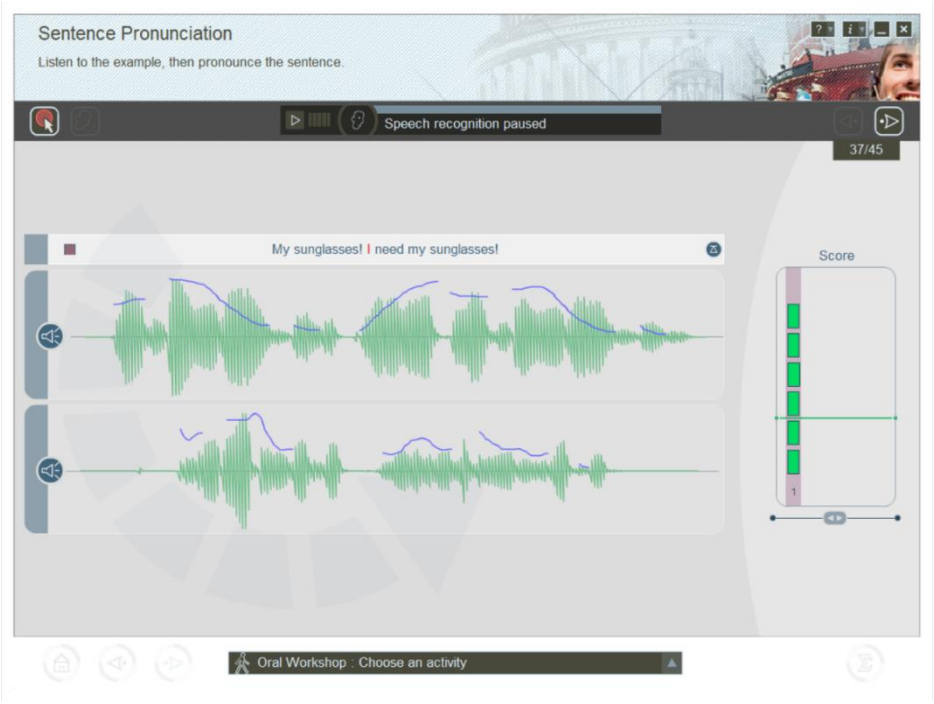
Objective:

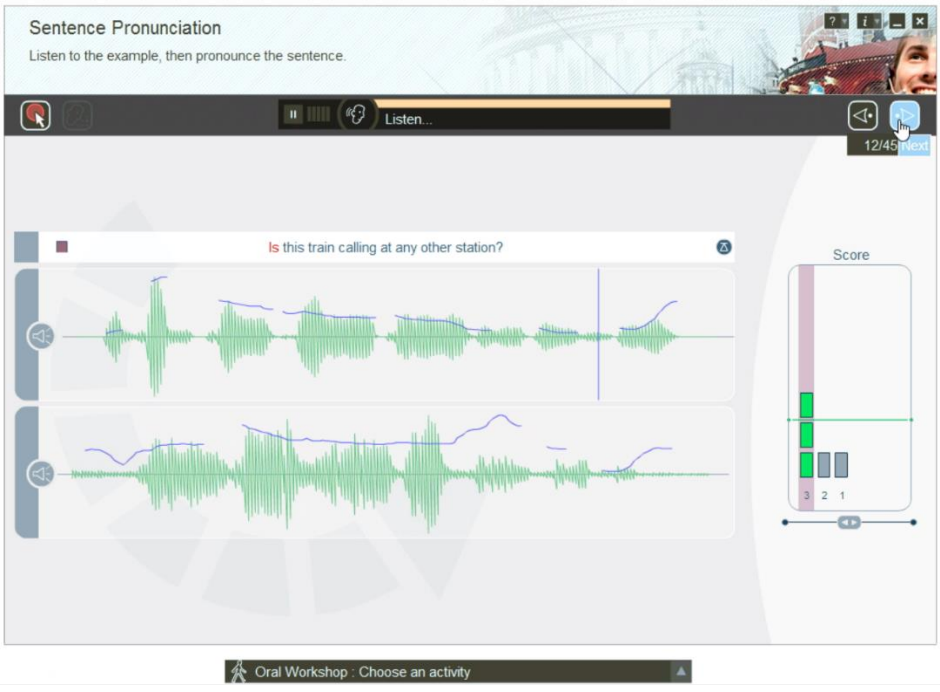
- By the end of this session students will have had the chance to practice the three prosody features simultaneously through listen and repeat and listen and choose the correct answer activities in the ASR based CAPT system Tell Me More.

Timing	**Activity**	**Student Activity**	**Aim of the activity**	**Resources needed**
30 minutes	Sentence pronunciation training using the "listen and repeat" activity "Climbing equipment" with the CAPT platform Tell Me More	Students will use Tell Me More to practice sentence pronunciation	To give students opportunity to practice prosody features using an ASR based CAPT system	Tell Me More software
30 minutes	Sentence pronunciation training using the "listen and choose the correct answer" activity "Climbing equipment" with the CAPT platform Tell Me More	Students will use Tell Me More to practice sentence pronunciation	To give students opportunity to practice prosody features using an ASR based CAPT system	- Tell Me More software

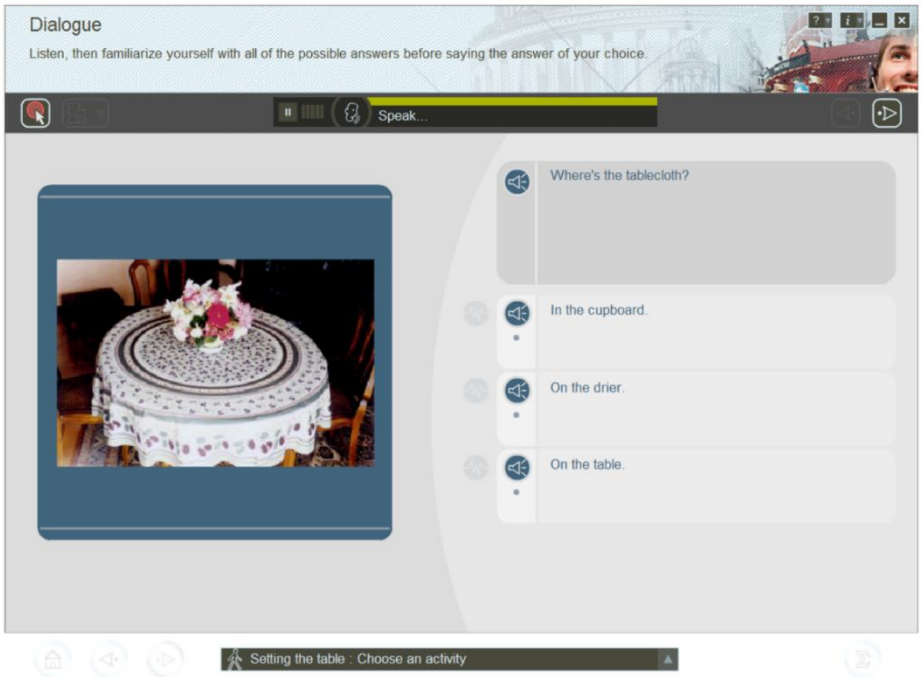
7.3 Appendix 3. Examples of CAPT Activities

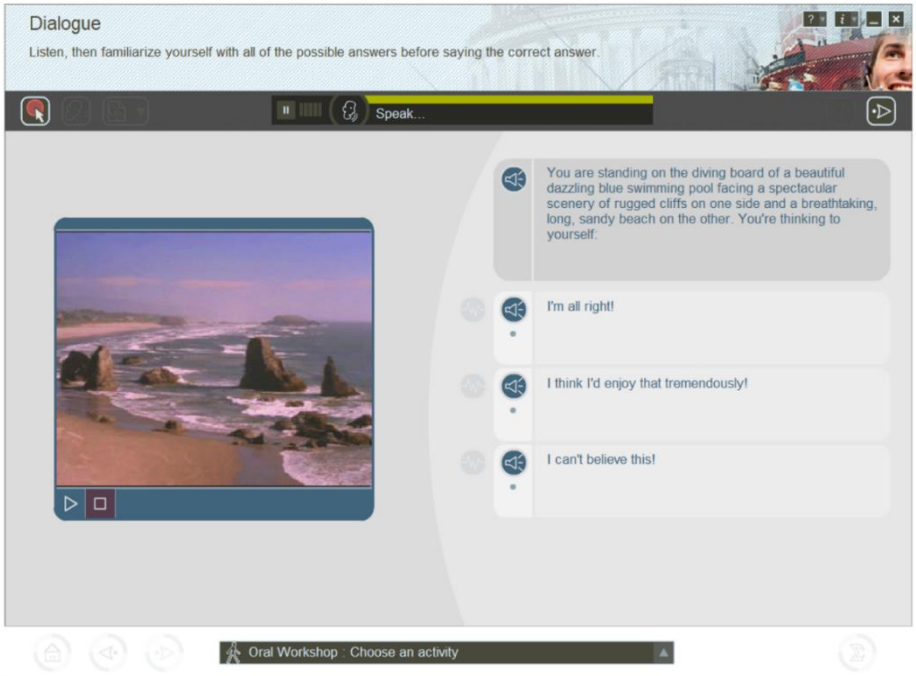
7.3.1 Example of “listen & repeat activities” activities in Tell Me More English





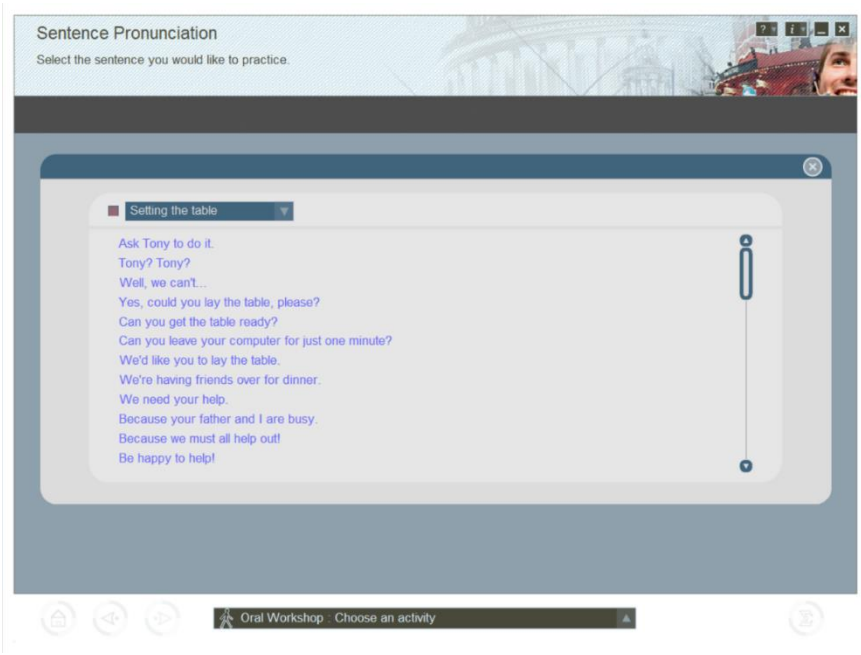
7.3.2 Examples of “listen & choose the correct answer” activities in Tell Me More

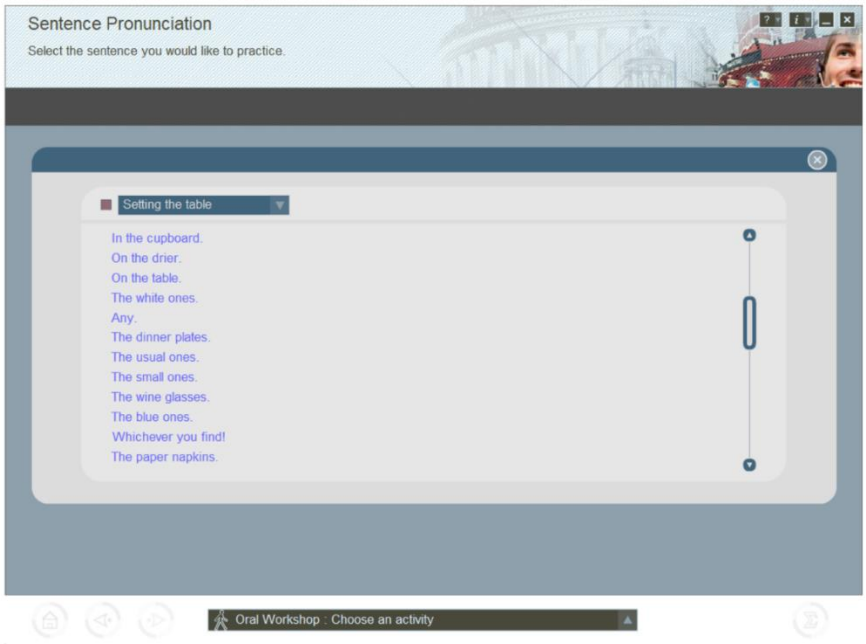


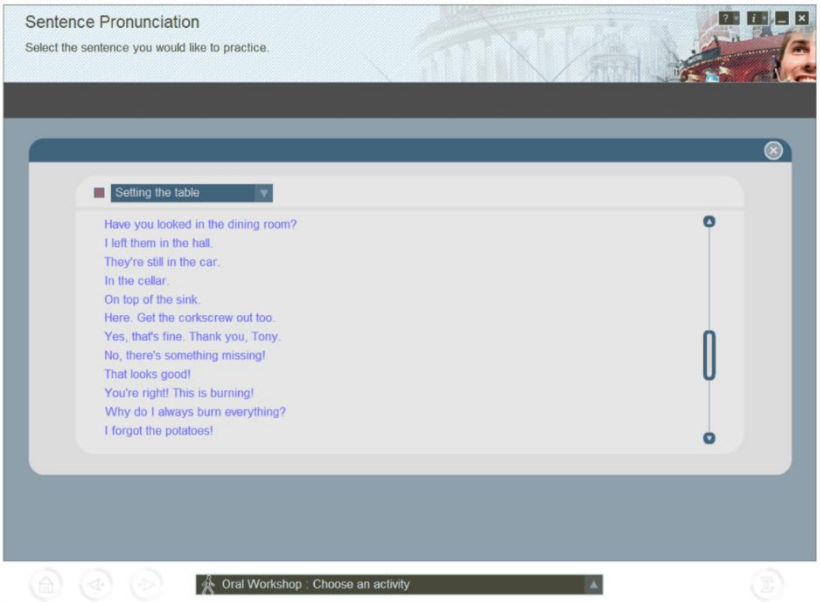


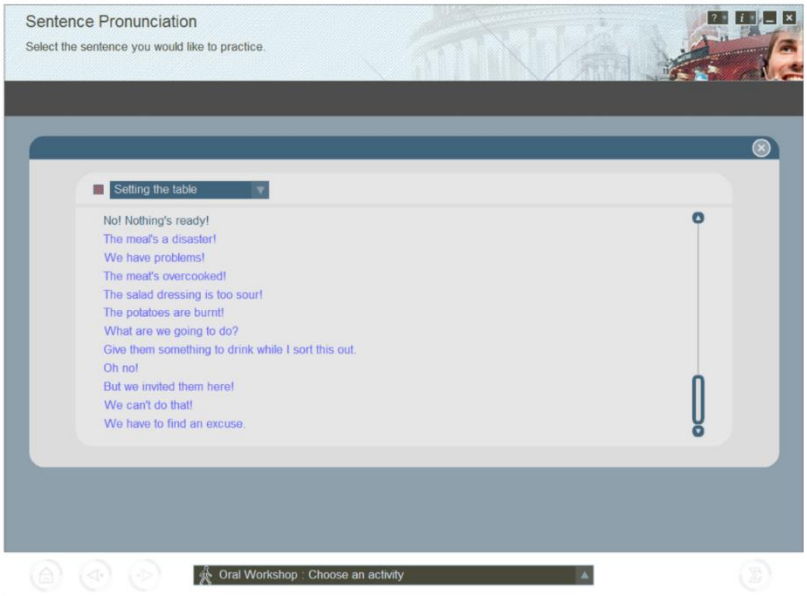
7.4 Appendix 4. The Sentences Practiced During the Training Sessions

7.4.1 Session one: Setting the table

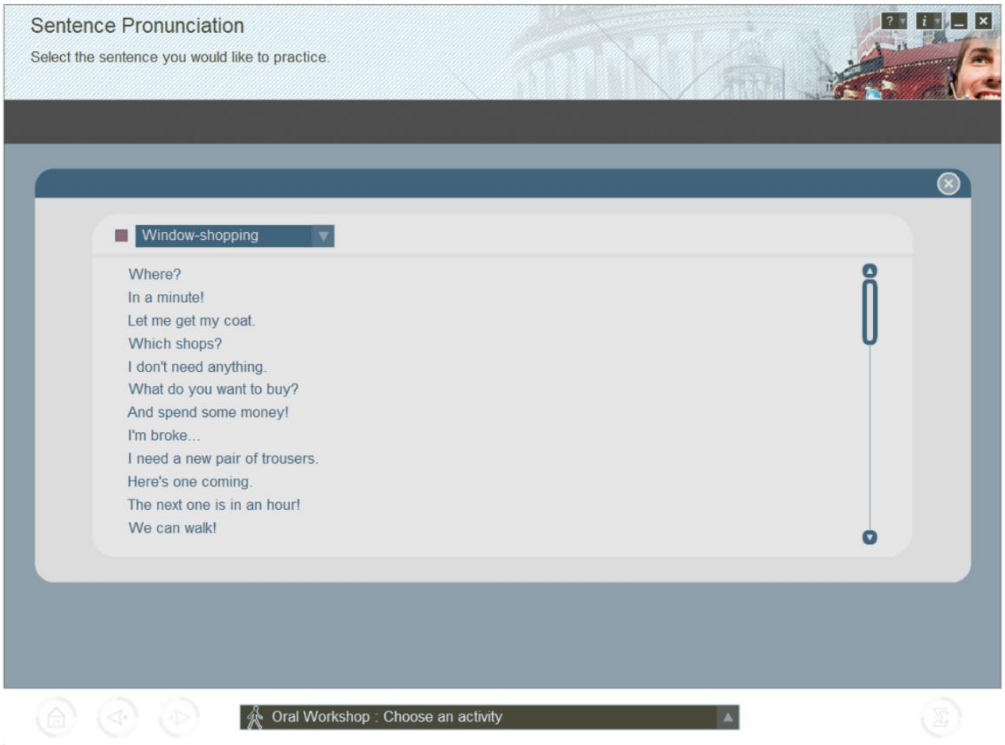


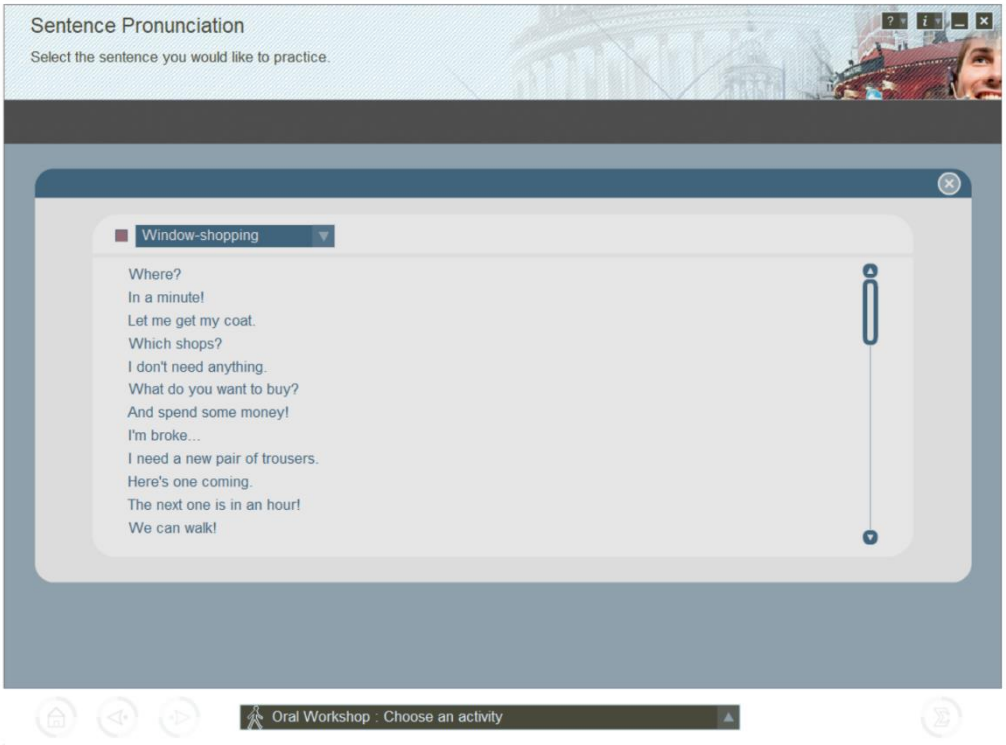


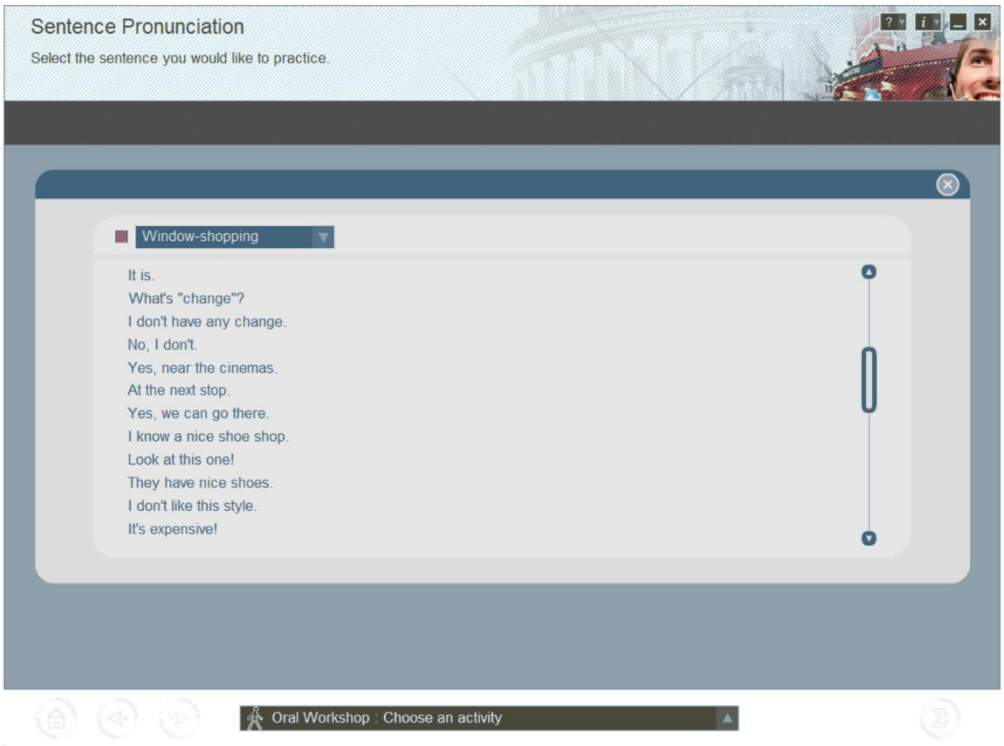

Sentence Pronunciation
Select the sentence you would like to practice.
Setting the table
Have you looked in the dining room?
I left them in the hall.
They're still in the car.
In the cellar.
On top of the sink.
Here. Get the corkscrew out too.
Yes, that's fine. Thank you, Tony.
No, there's something missing!
That looks good!
You're right! This is burning!
Why do I always burn everything?
I forgot the potatoes!
Oral Workshop : Choose an activity

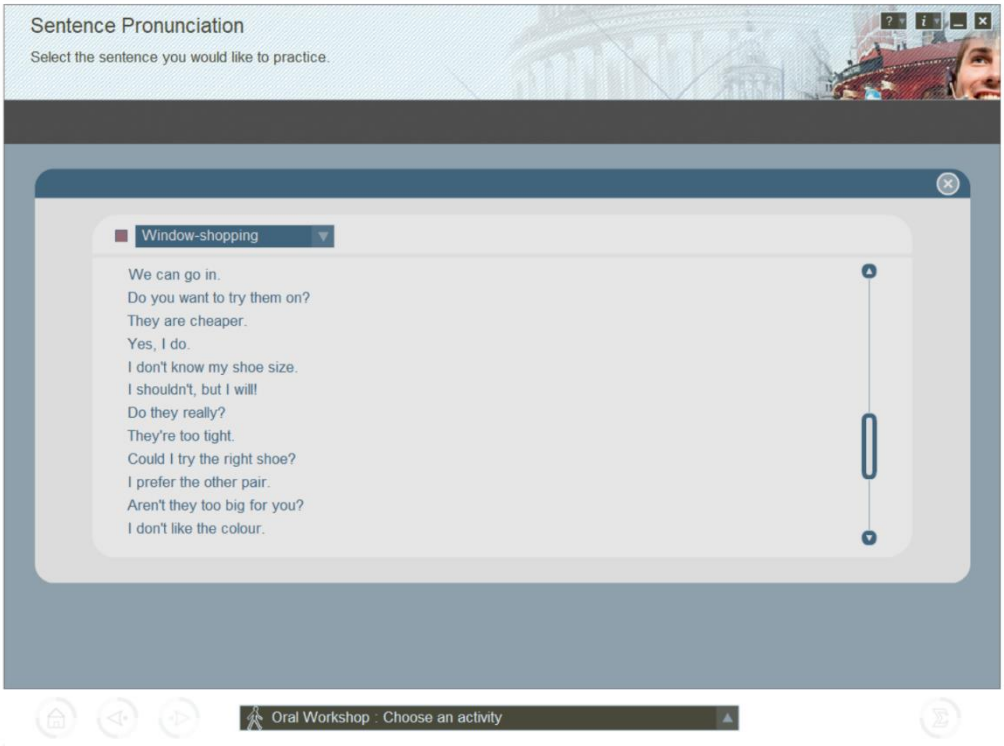

Sentence Pronunciation
Select the sentence you would like to practice.
Setting the table
No! Nothing's ready!
The meal's a disaster!
We have problems!
The meat's overcooked!
The salad dressing is too sour!
The potatoes are burnt!
What are we going to do?
Give them something to drink while I sort this out.
Oh no!
But we invited them here!
We can't do that!
We have to find an excuse.
Oral Workshop : Choose an activity

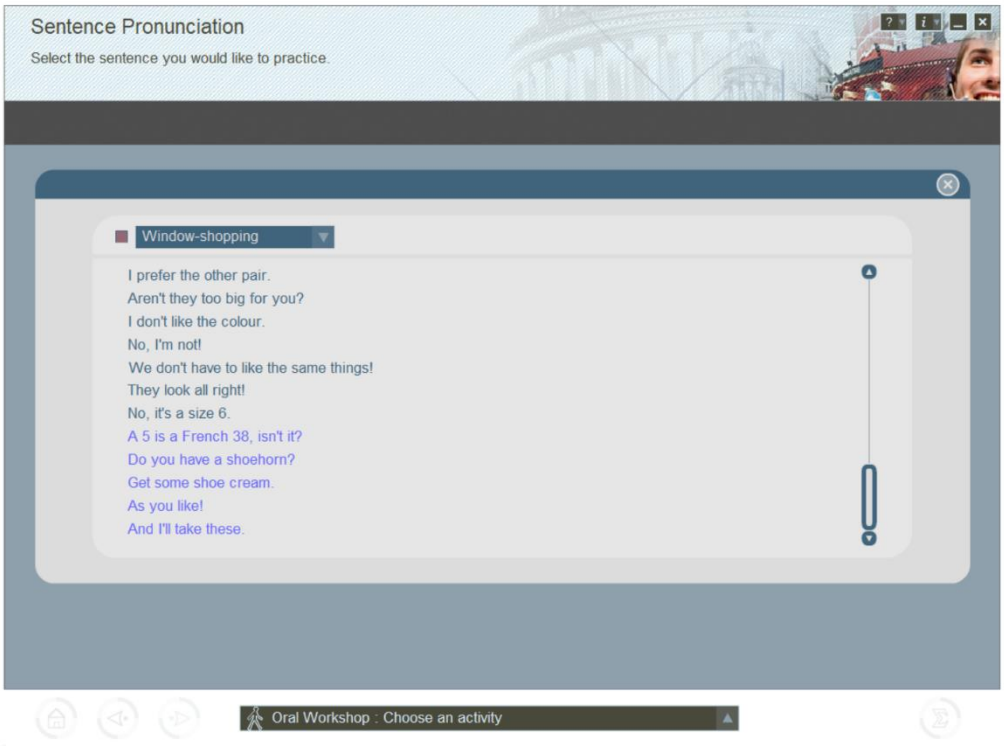
7.4.2 Session two: Window-shopping



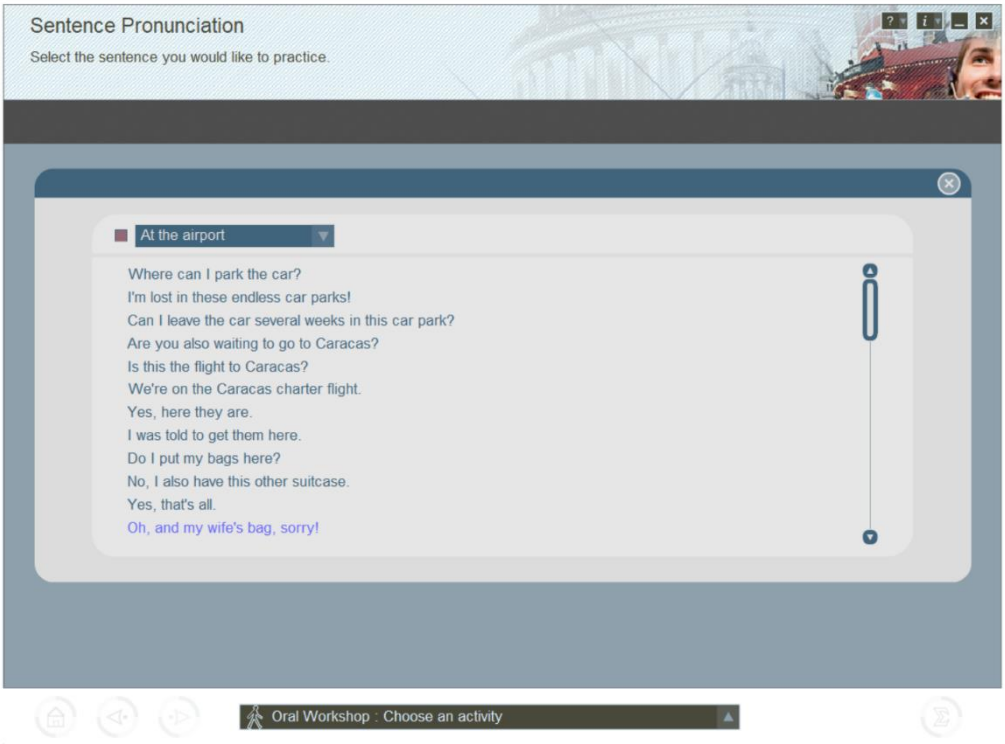


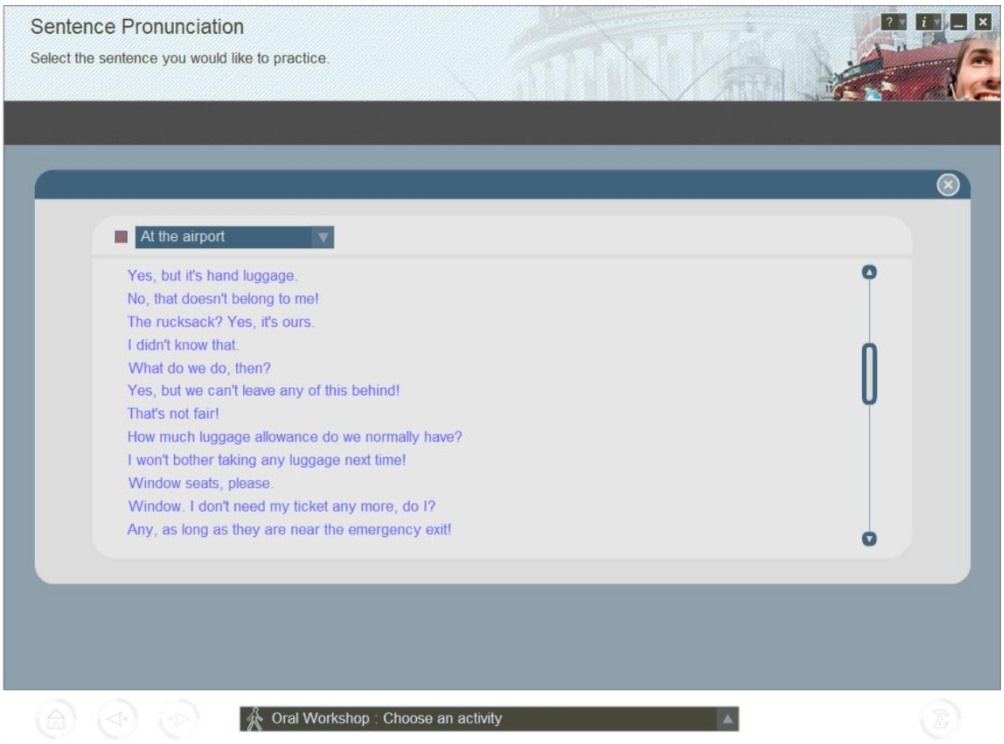

Sentence Pronunciation
Select the sentence you would like to practice.
Window-shopping
It is.
What's "change"?
I don't have any change.
No, I don't.
Yes, near the cinemas.
At the next stop.
Yes, we can go there.
I know a nice shoe shop.
Look at this one!
They have nice shoes.
I don't like this style.
It's expensive!
Oral Workshop : Choose an activity

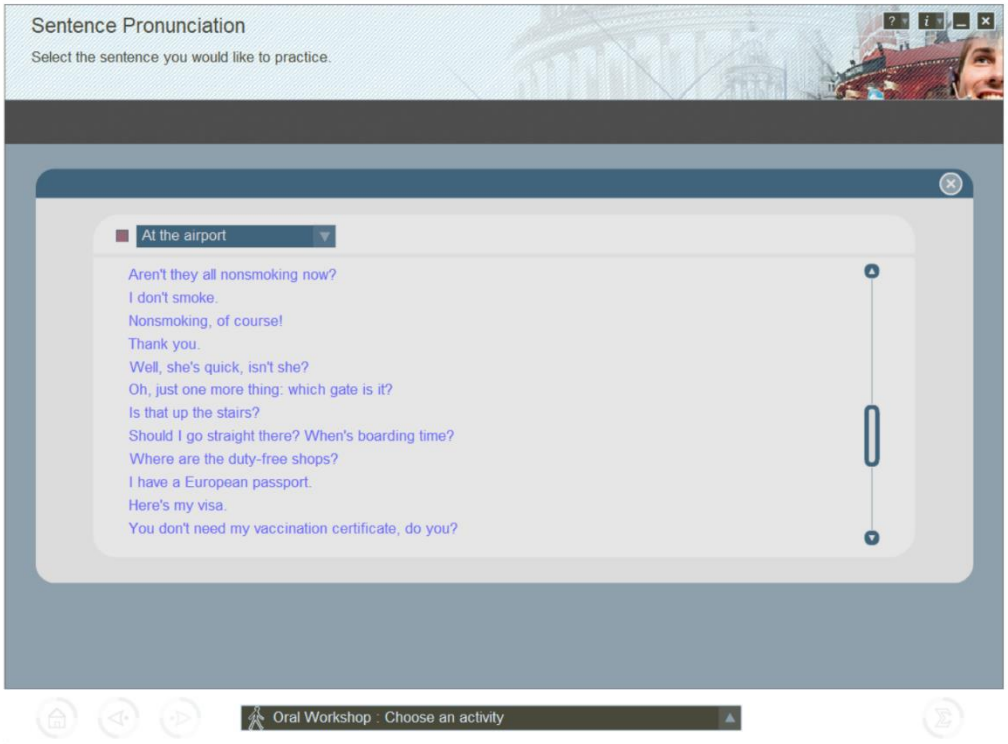

Sentence Pronunciation
Select the sentence you would like to practice.
Window-shopping
We can go in.
Do you want to try them on?
They are cheaper.
Yes, I do.
I don't know my shoe size.
I shouldn't, but I will!
Do they really?
They're too tight.
Could I try the right shoe?
I prefer the other pair.
Aren't they too big for you?
I don't like the colour.
Oral Workshop : Choose an activity

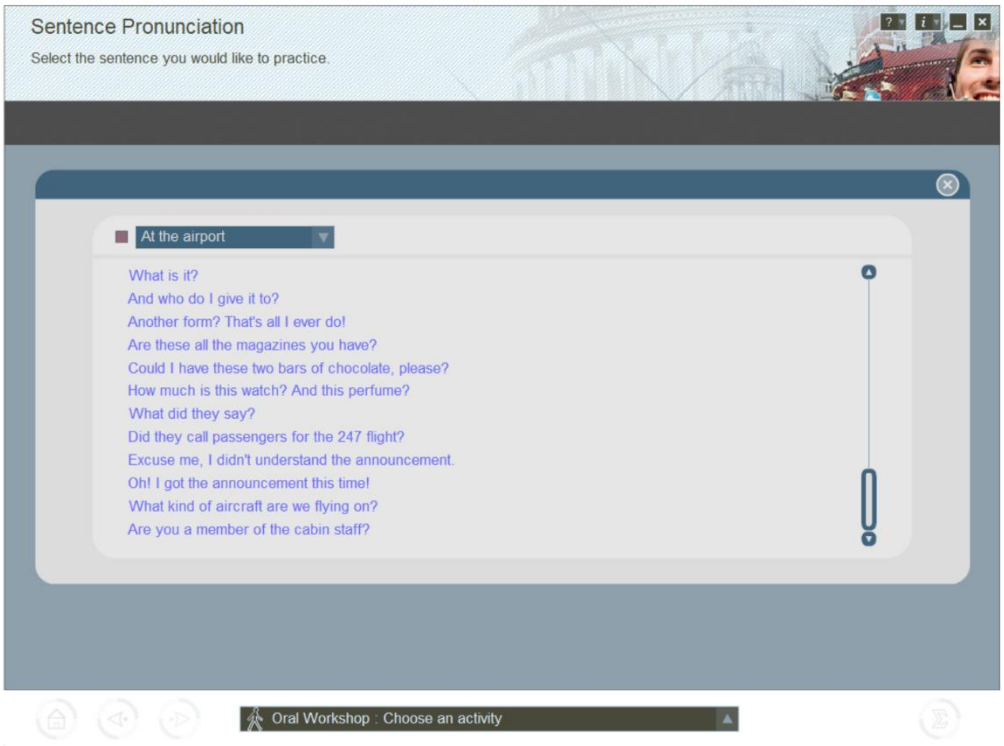


7.4.3 Session three: At the airport

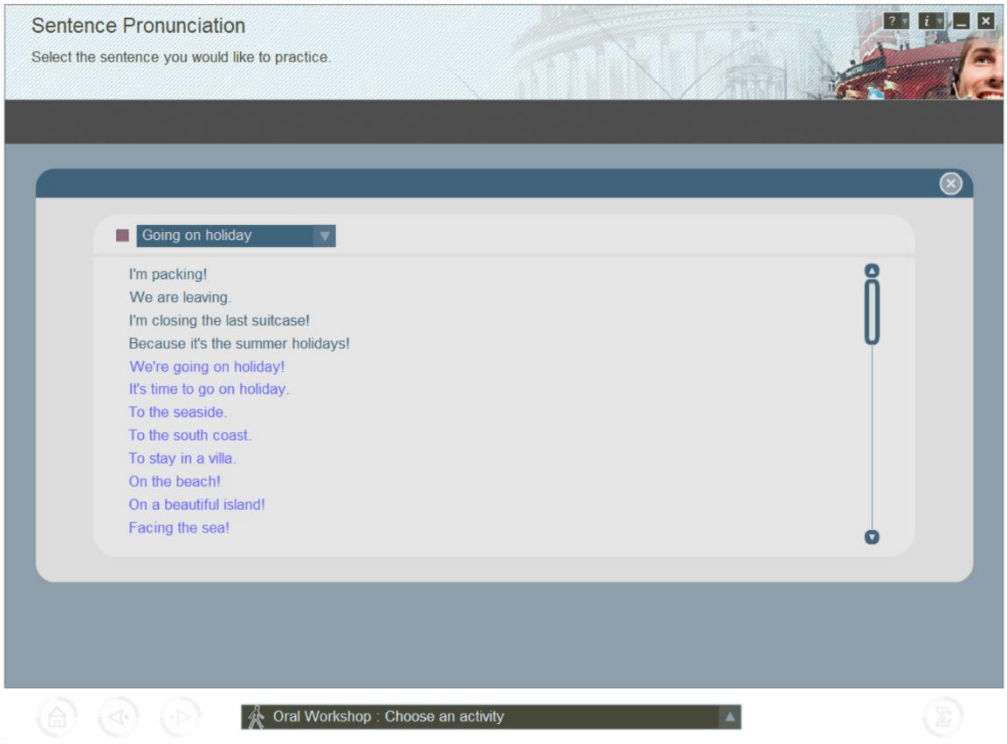


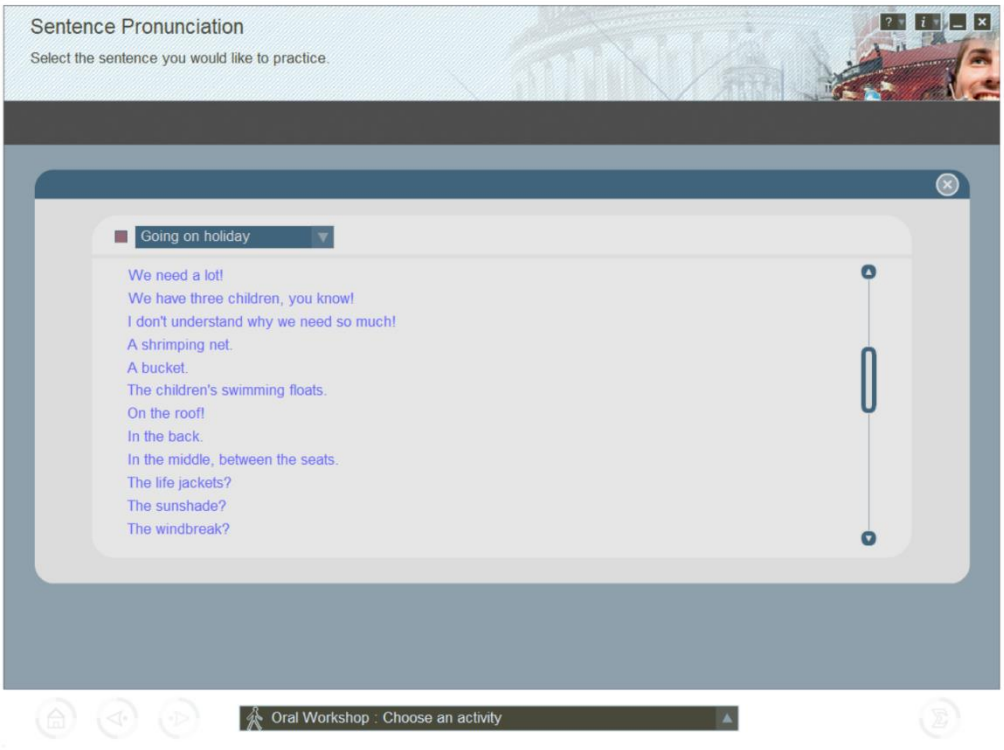

Sentence Pronunciation
Select the sentence you would like to practice.
At the airport
Yes, but it's hand luggage.
No, that doesn't belong to me!
The rucksack? Yes, it's ours.
I didn't know that.
What do we do, then?
Yes, but we can't leave any of this behind!
That's not fair!
How much luggage allowance do we normally have?
I won't bother taking any luggage next time!
Window seats, please.
Window. I don't need my ticket any more, do I?
Any, as long as they are near the emergency exit!
Oral Workshop : Choose an activity

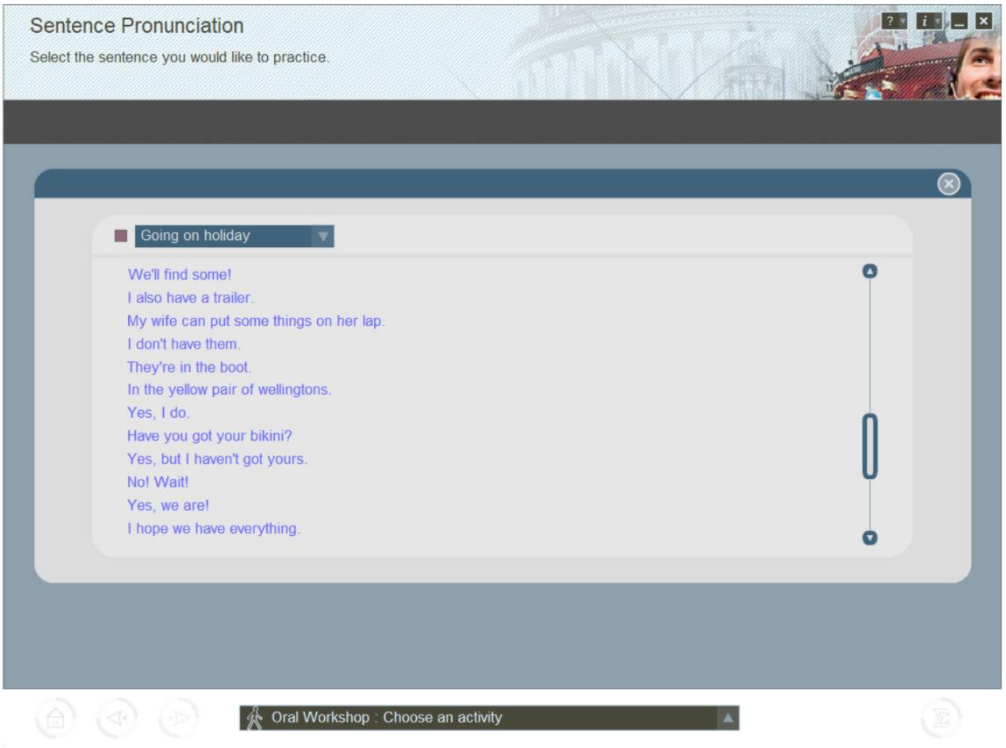

Sentence Pronunciation
Select the sentence you would like to practice.
At the airport
Aren't they all nonsmoking now?
I don't smoke.
Nonsmoking, of course!
Thank you.
Well, she's quick, isn't she?
Oh, just one more thing: which gate is it?
Is that up the stairs?
Should I go straight there? When's boarding time?
Where are the duty-free shops?
I have a European passport.
Here's my visa.
You don't need my vaccination certificate, do you?
Oral Workshop : Choose an activity

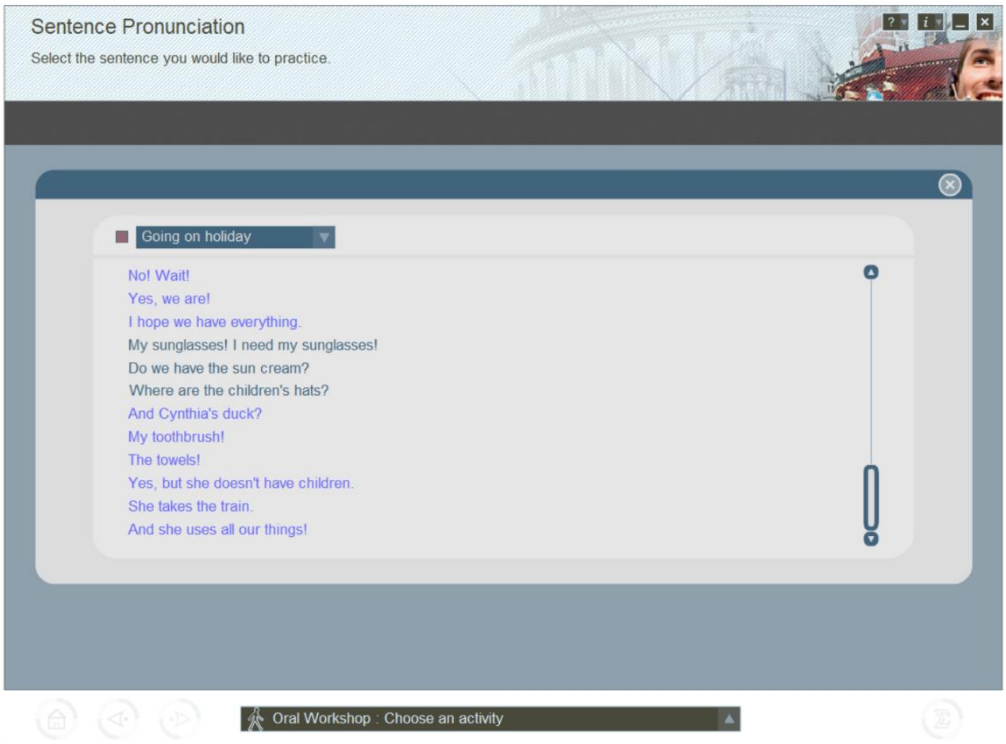


7.4.4 Session four: Going on holiday

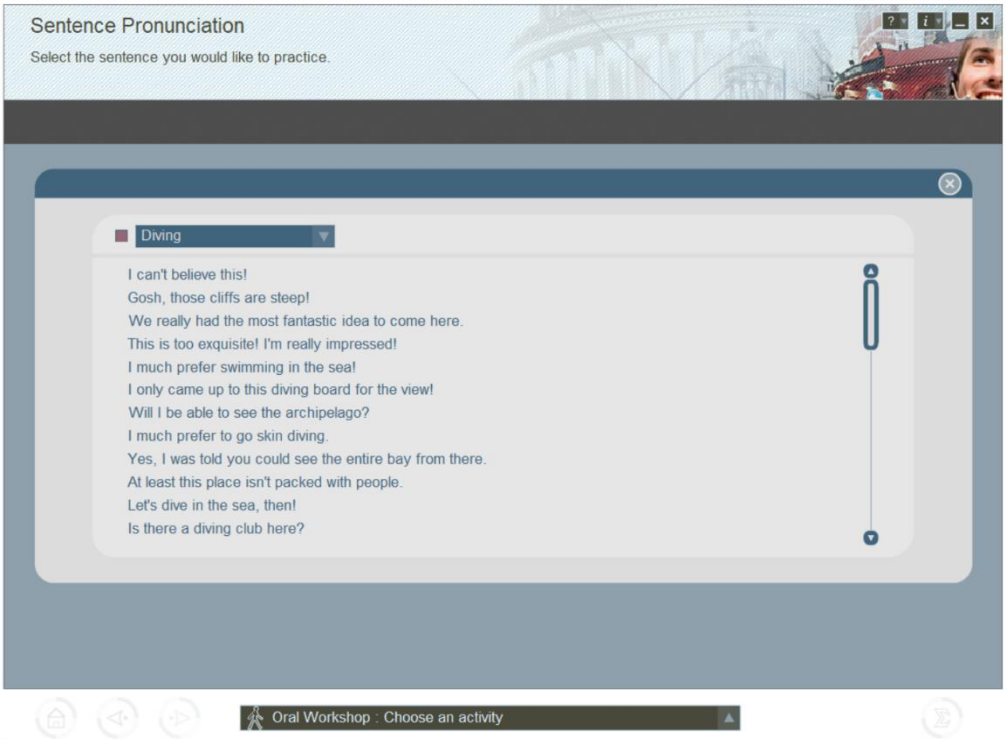


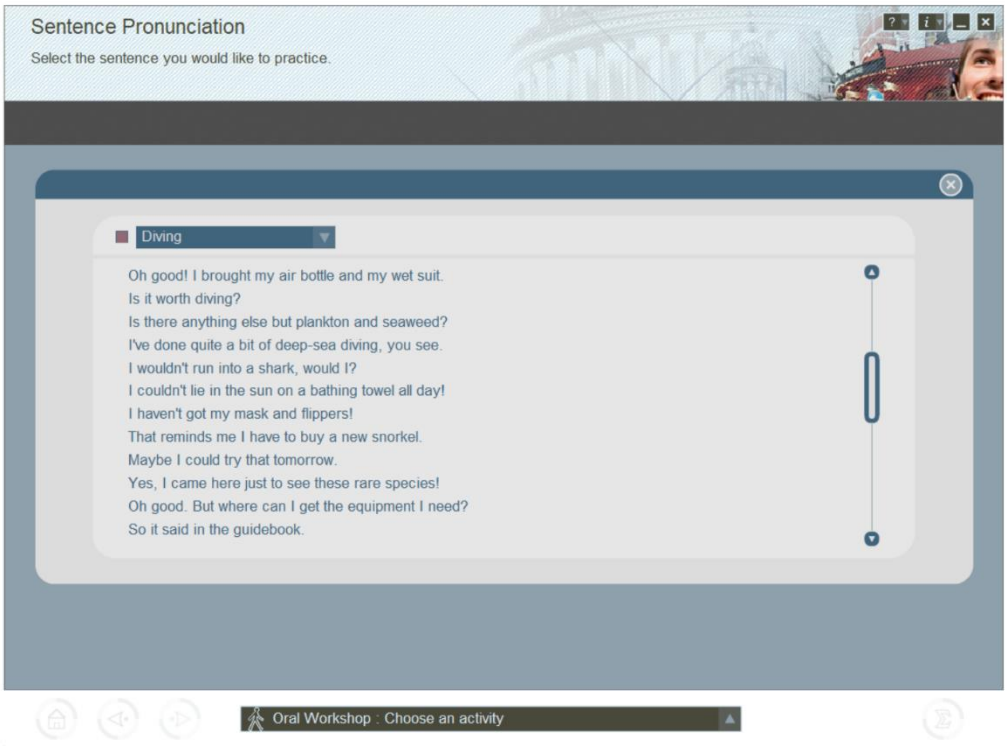

Sentence Pronunciation
Select the sentence you would like to practice.
Going on holiday
We need a lot!
We have three children, you know!
I don't understand why we need so much!
A shrimping net.
A bucket.
The children's swimming floats.
On the roof!
In the back.
In the middle, between the seats.
The life jackets?
The sunshade?
The windbreak?
Oral Workshop : Choose an activity

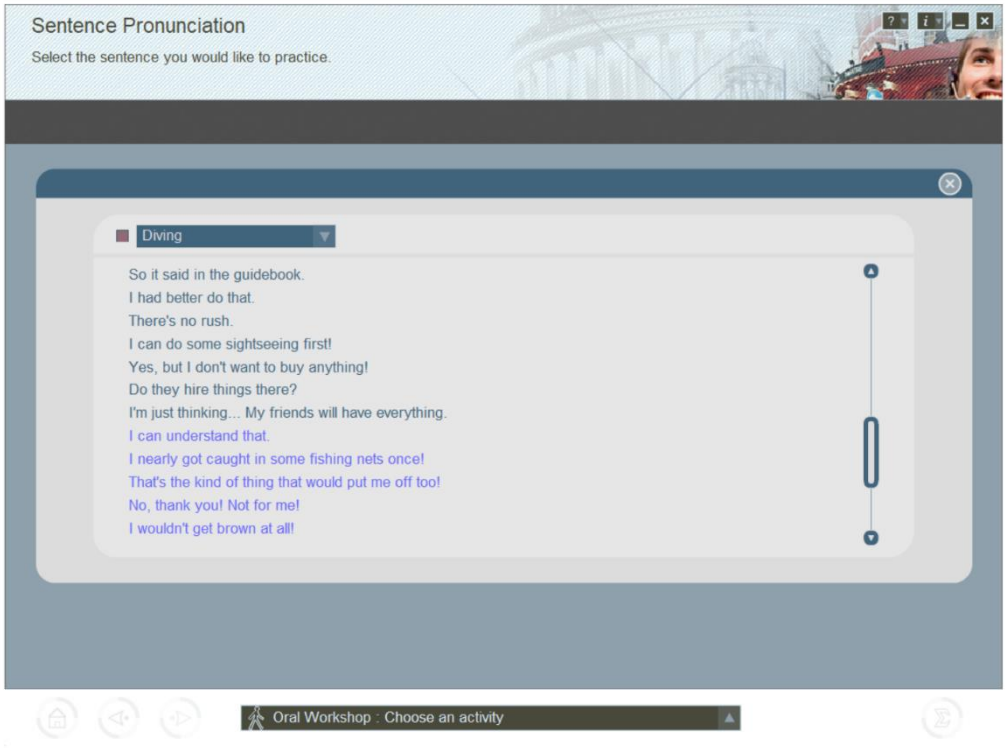

Sentence Pronunciation
Select the sentence you would like to practice.
Going on holiday
We'll find some!
I also have a trailer.
My wife can put some things on her lap.
I don't have them.
They're in the boot.
In the yellow pair of wellingtons.
Yes, I do.
Have you got your bikini?
Yes, but I haven't got yours.
No! Wait!
Yes, we are!
I hope we have everything.
Oral Workshop : Choose an activity

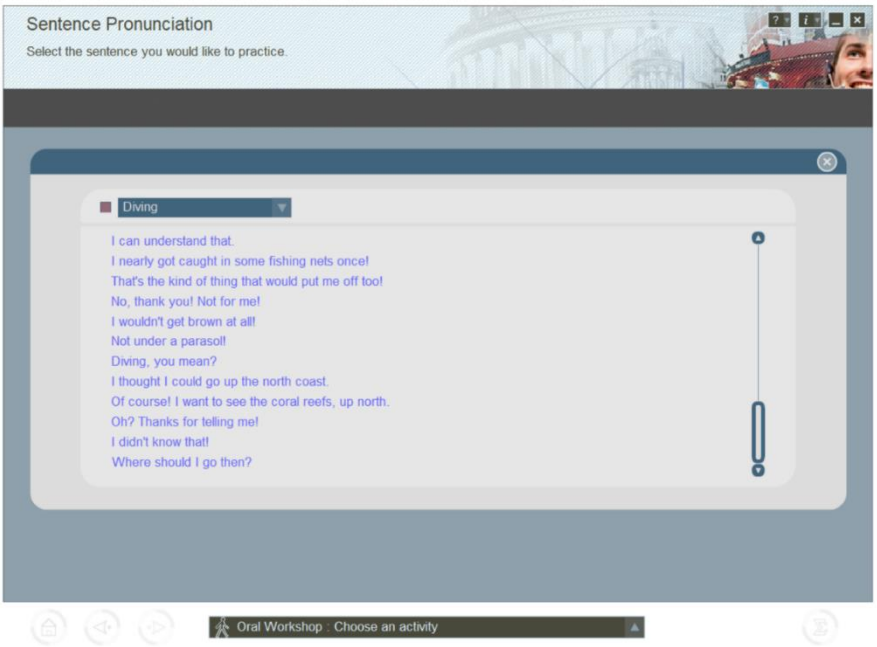


Session five: Diving

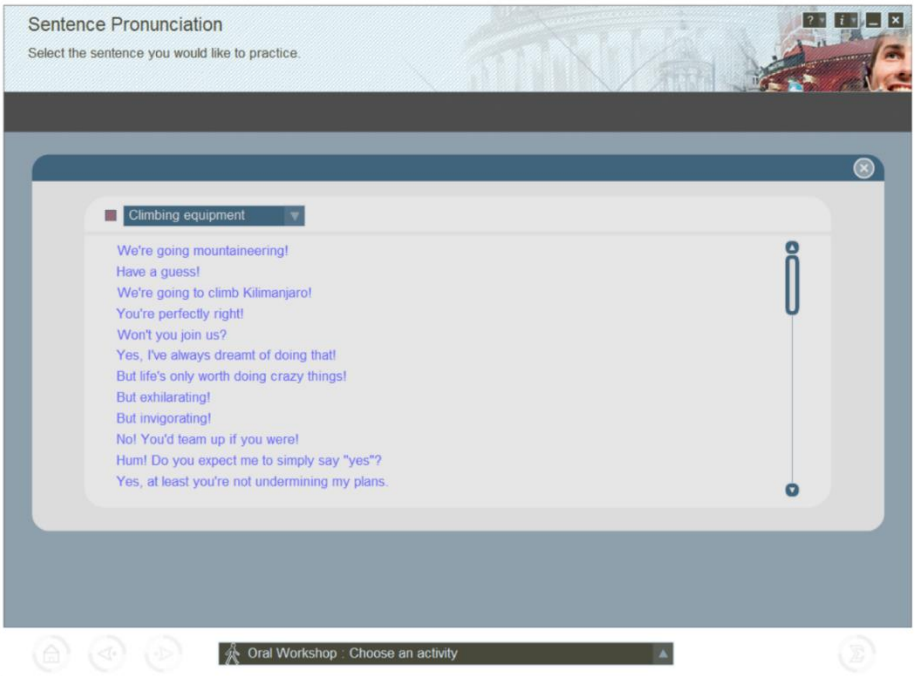


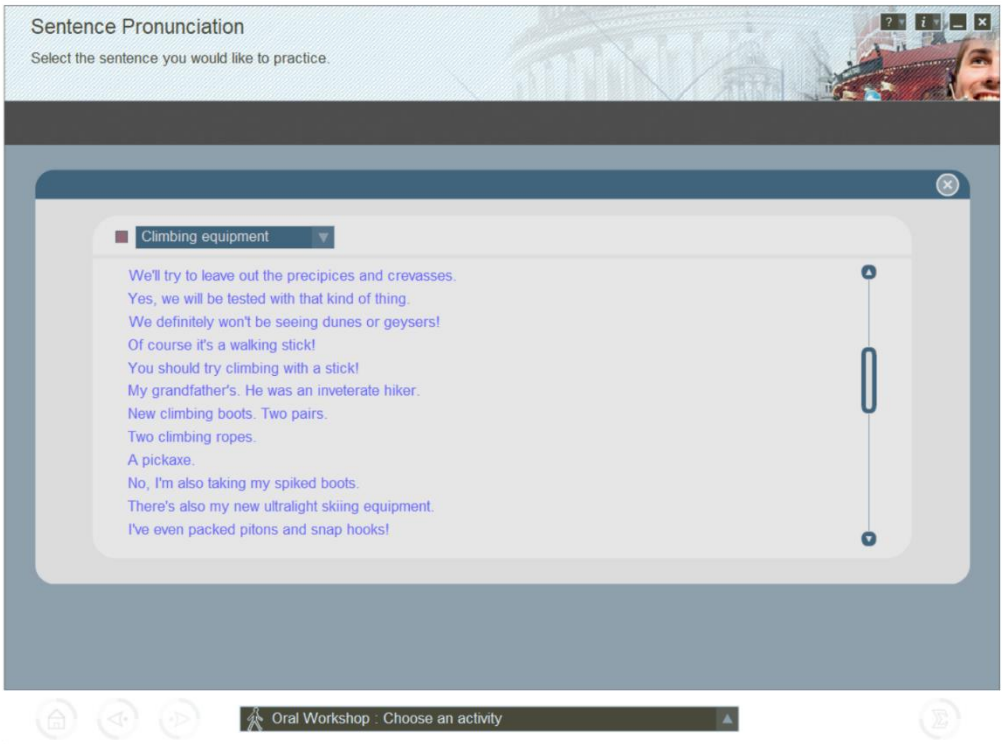

Sentence Pronunciation
Select the sentence you would like to practice.
Diving
Oh good! I brought my air bottle and my wet suit.
Is it worth diving?
Is there anything else but plankton and seaweed?
I've done quite a bit of deep-sea diving, you see.
I wouldn't run into a shark, would I?
I couldn't lie in the sun on a bathing towel all day!
I haven't got my mask and flippers!
That reminds me I have to buy a new snorkel.
Maybe I could try that tomorrow.
Yes, I came here just to see these rare species!
Oh good. But where can I get the equipment I need?
So it said in the guidebook.
Oral Workshop : Choose an activity

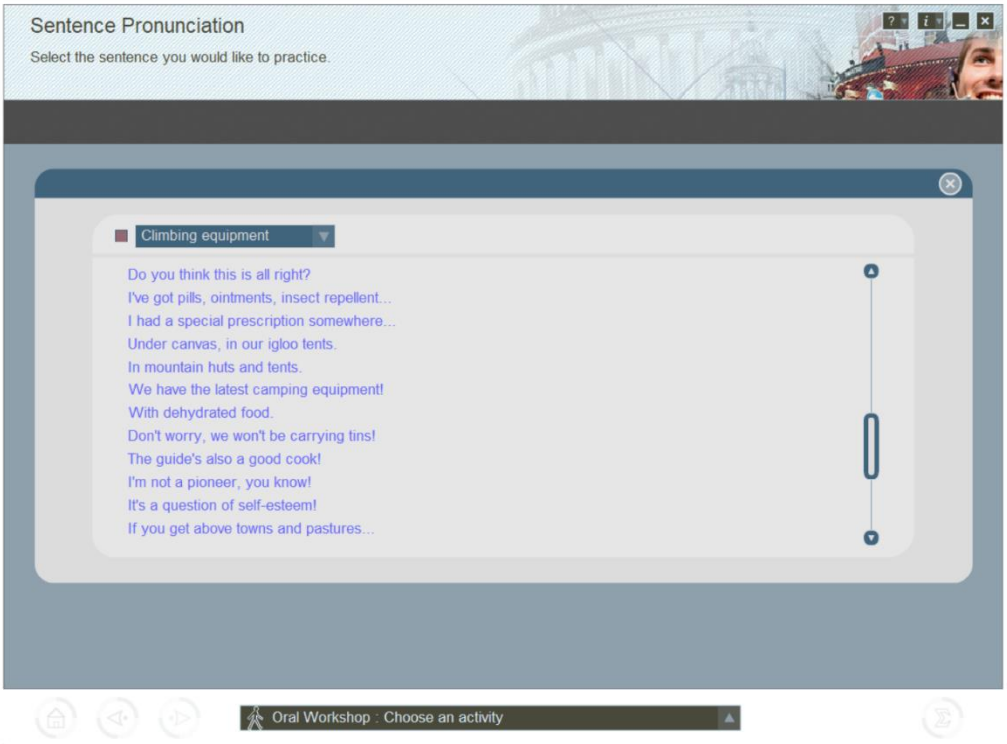

Sentence Pronunciation
Select the sentence you would like to practice.
Diving
So it said in the guidebook.
I had better do that.
There's no rush.
I can do some sightseeing first!
Yes, but I don't want to buy anything!
Do they hire things there?
I'm just thinking... My friends will have everything.
I can understand that.
I nearly got caught in some fishing nets once!
That's the kind of thing that would put me off too!
No, thank you! Not for me!
I wouldn't get brown at all!
Oral Workshop : Choose an activity

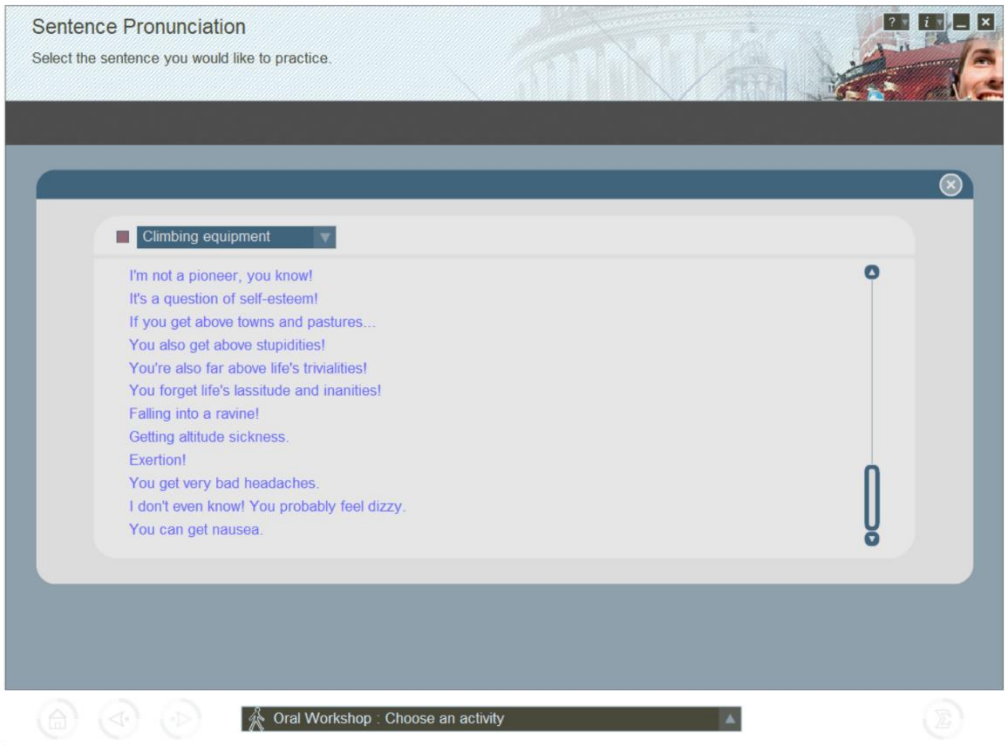


7.4.5 Session six: Climbing equipment




Sentence Pronunciation
Select the sentence you would like to practice.
Climbing equipment
We'll try to leave out the precipices and crevasses.
Yes, we will be tested with that kind of thing.
We definitely won't be seeing dunes or geysers!
Of course it's a walking stick!
You should try climbing with a stick!
My grandfather's. He was an inveterate hiker.
New climbing boots. Two pairs.
Two climbing ropes.
A pickaxe.
No, I'm also taking my spiked boots.
There's also my new ultralight skiing equipment.
I've even packed pitons and snap hooks!
Oral Workshop : Choose an activity


Sentence Pronunciation
Select the sentence you would like to practice.
Climbing equipment
Do you think this is all right?
I've got pills, ointments, insect repellent...
I had a special prescription somewhere...
Under canvas, in our igloo tents.
In mountain huts and tents.
We have the latest camping equipment!
With dehydrated food.
Don't worry, we won't be carrying tins!
The guide's also a good cook!
I'm not a pioneer, you know!
It's a question of self-esteem!
If you get above towns and pastures...
Oral Workshop : Choose an activity


Sentence Pronunciation
Select the sentence you would like to practice.
Climbing equipment
I'm not a pioneer, you know!
It's a question of self-esteem!
If you get above towns and pastures...
You also get above stupidities!
You're also far above life's trivialities!
You forget life's lassitude and inanities!
Falling into a ravine!
Getting altitude sickness.
Exertion!
You get very bad headaches.
I don't even know! You probably feel dizzy.
You can get nausea.
Oral Workshop : Choose an activity

7.5 Appendix 5. Background Questionnaire

Exploring the pedagogy of pronunciation training using CAPT technology in the EFL classroom environment

Case study of first year EFL university students in Algeria

Students' questionnaire

This questionnaire is a data collection tool within the practical part of a Ph.D. study that is investigating the value of pronunciation teaching using computer assisted pronunciation training with EFL students in Algeria. Your Participation in the study is voluntary, and your answers to the questionnaire will be dealt with anonymously and, therefore, you will not be identified as an individual in the final research.

I. Pre-intervention questionnaire

1. General information

Please first answer these general information questions, and then complete rest of the questionnaire:

Full name: ……

Gender: Male ☐ Female ☐

Age: ……

High school major: ……..

Number of years learning English: ……...

Baccalaureate result in English: ….....

2. Background information

Read the following questions, tick the appropriate box and justify you answers:

1- How do you describe your English pronunciation level?

☐ Poor ☐ Average ☐ Good ☐ Excellent

2- What type of pronunciation do you prefer?

☐ American pronunciation ☐ British pronunciation ☐ Standard English

3- What do you aim at when learning English pronunciation?

☐ Native like pronunciation ☐ Intelligible (clear) pronunciation

Why?

……

1- To what extent do you think pronunciation training is necessary to improve your speaking skill in English?

☐ Unnecessary ☐ Partially important ☐ Important ☐ Highly important

2- To what extent are you satisfied about pronunciation learning in your classroom?

☐ Not satisfied ☐ Partially satisfied ☐ Satisfied ☐ Highly satisfied

Why?

……

3- Do you have experience using computer assisted language learning programs?

☐ Yes ☐ No

If yes, please name the program: …….

4- Do you have experience using language learning programs to practice your speaking skill in English?

☐ Yes ☐ No

If yes, please name the program: …….

5- Do you have experience using computer assisted pronunciation training (CAPT) programs?

☐ Yes ☐ No

If yes, please name the program: …….

6- Do you think using computer assisted pronunciation could enhance your pronunciation in English? (rating questions)

☐ Yes ☐ No

If yes, please specify the reasons:

Self-paced training ☐
Immediate feedback ☐
It is easy to access ☐
It is easy to use ☐
Other ☐

7.6 Appendix 6. Learning Log Form

LEARNING LOG

Full name: .....
Date: .....

How do you rate today's session?

Please **circle** one answer and briefly **explain it**

I liked the session very much	I liked the session	I don't know	I didn't like the session	I didn't like the session at all
Please explain here:				

Did you learn anything from today's session?

Pease, **circle** one answer and briefly **explain it**

YES	NO
If YES, please state what you learned:	If NO; what prevented you from learning?

Did the **computer program** help you learn anything about today's lesson?

Please, **circle** one answer and briefly **explain it**

YES	NO
If YES, please explain:	If NO, Why?

Would you like to learn more about today's topic?

Please, **circle** one answer and briefly **explain it**

YES	NO
If YES, please explain:	If NO, Why?

7.7 Appendix 7. Interview Questions

1- How do you describe the experience of pronunciation training with the CAPT technology MyET?

2- Do you feel that you have made a progress with your English pronunciation after the training? And why?

3- What aspects of the CAPT technology did you find most helpful for practicing English pronunciation? What are they? Are they helpful? And Why?

4- What do you think/ feel about the immediate visual feedback?

5- Were you able to understand and interpret the feedback?

6- Are there any elements in the visual feedback that you found helpful? What are they? And why are they helpful?

7- What do you think about the generated scores? Do you think they reflect your pronunciation level?

8- What do you think about the sentence pronunciation activities in the CAPT technology MyET? Can you describe one activity that you found interesting?

9- Are you comfortable with using CAPT? Would you prefer pronunciation training in the classroom than using technology? And why?

10- What do you think was the most challenging aspect about using CAPT technology?

11- Would you use similar platforms in the future? If yes: what platforms? And Why, if no: why?

7.8 Appendix 8. The Reading Text for the Pronunciation Learning Pre-Test

A FUTURE IN THE COUNTRY?

More and more people want to live the rural life... but... City life is cool; but is country life cooler?

Apparently yes.

More and more people in Britain want to live in the country, and this is causing more and more problems in some rural areas. The population of British cities has been falling for years. Cities like Liverpool and Glasgow have lost about 30% of their population in 30 years. But Britain's population is still growing. Where are the people going?

Answer: to the country. The English countryside has a classic image. People imagine that life in the country is slow and calm; that there are no traffic jams, no pollution, and no crime. In some places, this is true; but in others it is not.

Small towns and villages are becoming more and more popular; people have more space and most houses have gardens. But problems are growing. Lots of people want to live in the country and work in the city; so more and more people travel long distances each day, to go to work. Of course they don't use buses (they are too slow) or trains (they don't stop in the country); they use cars. And although they live in the country, they want to use supermarkets and good fast roads.... but they do not want to see them or hear them. Besides, lots of young people say that life in the country is boring: there is not enough to do, there are not enough activities and excitements.

Little villages now have traffic problems in the morning, just like big cities! And they are getting worse.

The problems are very complicated! If everyone moves into the country, large parts of the countryside will disappear! People leave cities and big towns, to escape from urban problems; but more and more, they are bringing their problems with them.

On warm summer days, and cold winter days, air pollution can be a big problem in large parts of the south of England, not just in London. Traffic jams are now often part of life, even in the country; crime has become a serious problem in rural areas.

Perhaps there is hope for the future. Soon Britain's population will stop rising. From about the year 2020, it will perhaps start to fall. In 100 year's time, there will be less people in Britain than today - perhaps two million less. No doubt there will be less pollution too; oil and petrol will probably be rare by then.

7.9 Appendix 9. The Reading Text for the Pronunciation Learning Post-Test

Life on Mars?

Making the red planet go green

If we tried to, could we really transform the frozen surface of Mars into something more friendly – a place where humans could live? And equally importantly, should we?

The first question has a clear answer: Yes, we probably could. Most of the work in 'terraforming', says NASA planetary scientist Chris McKay, would be done by life itself. 'We wouldn't have to build Mars, just modify its atmosphere,' McKay says. 'If we warmed it up and threw in some seeds, plants would grow there.'

Enthusiasts such as Robert Zubrin, president of the Mars Society, dream of Martian cities. Zubrin, an engineer, believes civilisation cannot succeed without limitless expansion. He also thinks that if we transformed Mars – a horrifying idea to some – we might learn to manage our limited Earth better. But if I was an astronaut, I wouldn't be keen on that six-month journey!

YEAR ZERO

1 The thousand-year project might begin with a series of eighteen-month survey missions. Each crew making the six-month journey from Earth to Mars would add a small habitation module to the base.

100 YEARS

2 An Earth-like atmosphere could be made. First, the carbon dioxide which is now frozen in the ice would be released. Maybe mirrors could focus sunlight on the ice to do this.

200 YEARS

3 With enough carbon dioxide, the temperature would go up and rain would fall. Algae and microbes could survive and transform the rocky surface.

600 YEARS

4 Flowering plants could be introduced when the microbes had created soil.

This would add oxygen to the atmosphere. Forests might even grow.

7.10 Appendix 10. Consent Form of Pronunciation Assessors

RATER CONSENT FORM

Project title:	A mixed method approach to exploring the use of CAPT technology in the EFL speaking class to teach prosody features: case study of second & third year EFL university students in Algeria
Researcher:	Moustafa Amrate
Supervisor:	Irena Kuzborska
Research method:	Mixed methods research
Data collection tools:	Classroom observation (using camera & screen recordings), learning logs, structured & semi-structured questionnaires, semi-structured interviews and pronunciation tests (read aloud activities).
The purpose of the research:	To explore the pedagogy of using CAPT in a collaborative way to teach and practice prosody features in the EFL speaking class

The role of the rater: the role as a rater at this stage of the research is to listen to 12 audio recordings and rate the speech features presented in the rating forms. The audio file length range from 7 seconds minimum to 15 seconds maximum. You will be allowed to listen to each file twice to rate each speech feature. You are only allowed to listen to the audio file a third time in the case of a technical issue or external loud noise.

Anonymity and confidentiality: all the information participants provide will be encoded into the format of letters and numbers and therefore they will not be identified as individuals in the final research or other types of academic work based on these data. The encoding process will take place within seven days after the data collection.

Storing and using your data: the collected data will be securely stored in locked files within an external hard drive and only the researcher will be able to access the data. The data will be used as a part of the PhD thesis and research publications. After that, the results will be archived and it may be used for future research purposes. If participants do not want their data to be used as a result of this research, they will have all the freedom not sign this form or take part in this study.

In case you want to ask about further information concerning the research and students' involvement in the study please do not hesitate to get in touch with the researcher through the following contact details:

Researcher: ma1106@york.ac.uk
For queries, concerns and complaints please contact:
Education Ethics Committee: education-research-administrator@york.ac.uk

Thank you for taking time to read this information.
Yours sincerely
Moustafa Amrate

The following statements establishes that you have read and understood what taking part in this research study will involve. Please tick the boxes that apply.

1	I confirm that I have read and understood my role in this study.	☐
2	I understand that the data I provide will be anonymised and I will not be referred to as an individual in the final PhD research or any other types of academic publications based on these data.	☐
3	I understand that the data will be securely stored and archived for future research.	☐
4	I confirm that I have had the opportunity to ask questions.	☐
5	I agree to take part in this study.	☐

Full name: ..... **Contact details:**.....

Date: ..... **Signature:** .....

Thank you!

7.11 Appendix 11. Pronunciation Assessors' Information Form

RATER FORM

- Please first answer these general information questions and then proceed with the audio files:

Full name: .....

Gender: Male ☐ Female ☐

Age: .....

Country of birth: .....

Nationality: .....

Mother tongue: .....

Do you speak a second/ foreign language/ languages? Yes ☐ No ☐

If yes, what language/ languages? .....

Profession: .....

Do you have any listening difficulties? Yes ☐ No ☐

If yes, please specify: .....

Do you have experience with experience with non-speakers of English? Yes ☐ No ☐

If yes, for how long? (years) .....

Thank you for taking the time to complete this questionnaire!

7.12 Appendix 12. Comprehensibility Rating Form

Comprehensibility rating

Group: *Test:* *Rater:*

Listen carefully to the audio recordings and rate their comprehensibility on a scale from 1 (***extremely hard to understand***) to 9 (***extremely easy to understand***). Bear in mind that comprehensibility, in this case, refers only to the meaning and that other linguistic features like accent, fluency, or grammatical accuracy are irrelevant to the evaluation process.

After finishing this activity, you will be asked three simple questions about the content of the audio recordings.

Recording	***Extremely difficult to understand*** 1	2	3	4	5	6	7	8	***Extremely easy to understand*** 9
1	☐	☐	☐	☐	☐	☐	☐	☐	☐
2	☐	☐	☐	☐	☐	☐	☐	☐	☐
3	☐	☐	☐	☐	☐	☐	☐	☐	☐
4	☐	☐	☐	☐	☐	☐	☐	☐	☐
5	☐	☐	☐	☐	☐	☐	☐	☐	☐
6	☐	☐	☐	☐	☐	☐	☐	☐	☐
7	☐	☐	☐	☐	☐	☐	☐	☐	☐
8	☐	☐	☐	☐	☐	☐	☐	☐	☐
9	☐	☐	☐	☐	☐	☐	☐	☐	☐
10	☐	☐	☐	☐	☐	☐	☐	☐	☐
11	☐	☐	☐	☐	☐	☐	☐	☐	☐
12	☐	☐	☐	☐	☐	☐	☐	☐	☐
13	☐	☐	☐	☐	☐	☐	☐	☐	☐
14	☐	☐	☐	☐	☐	☐	☐	☐	☐
15	☐	☐	☐	☐	☐	☐	☐	☐	☐
16	☐	☐	☐	☐	☐	☐	☐	☐	☐
17	☐	☐	☐	☐	☐	☐	☐	☐	☐
18	☐	☐	☐	☐	☐	☐	☐	☐	☐

7.13 Appendix 13. Prosodic Coding Scheme

7.13.1 Pre-test: (A future in the country?)

7.13.1.1 Syllable stress

n	Multisyllabic words	Word type	Correctly placed syllable stress (1)	Misplaced syllable stress (0)
1	**fu**ture	Noun		
2	**coun**try	Noun		
3	**peo**ple	Plural noun		
4	**ru**ral	Adjective		
5	**ci**ty	Noun		
6	**coun**try	Noun		
7	**coo**ler?	Adjective		
8	A**ppa**rently	Sentence adverb		
9	**peo**ple	Plural noun		
10	**Bri**tain	Proper noun		
11	**coun**try	Noun		
12	**cau**sing	Verb		
13	**prob**lems	Noun		
14	**ru**ral	Adjective		
15	**ar**eas	Noun		
16	popu**la**tion	Noun		
17	**Bri**tish	Noun		
18	**ci**ties	Noun		
19	**fa**lling	Verb		
20	**Ci**ties	Noun		
21	**Li**verpool	Proper noun		
22	**Glas**gow	Proper noun		
23	a**bout**	Adverb		
24	**thir**ty	Cardinal number		
25	per**cent**	Adverb		
26	popu**la**tion	Noun		

27	**thir**ty	Cardinal number		
28	**Bri**tain's	Proper noun		
29	popu**la**tion	Noun		
30	**grow**ing	Verb		
31	**peo**ple	Plural noun		
32	**go**ing	Verb		
33	**An**swer	Noun		
34	**coun**try	Noun		
35	**Eng**lish	Adjective		
36	**coun**tryside	Noun		
37	**cla**ssic	Adjective		
38	**im**age	Noun		
39	**Peo**ple	Plural noun		
40	i**ma**gine	Verb		
41	**coun**try	Noun		
42	**tra**ffic	Noun		
43	po**llu**tion	Noun		
44	**pla**ces	Noun		
45	**o**thers	Adjective		
Totals				

7.13.1.2 Sentence stress

n	Sentences	Correct use	Content words (/82)	Correct use	Function words (/51)
1	A **FUTURE** IN THE **COUNTRY**?		2		3
2	***More*** *and* ***more people want*** *to* ***live*** *the* ***rural life***		7		3
3	*... **but**... **City life** is **cool**; **but** is **country life cooler**?*		8		2
4	***Apparently yes***.		2		0
5	**More** and **more people** in **Britain want** to **live** in the **country**, and **this** is **causing more** and **more problems** in some **rural areas**.		14		10
6	The **population** of **British cities** has been **falling** for **years**.		5		5
7	**Cities** like **Liverpool** and **Glasgow** have **lost** about **30 percent** of their **population** in **30 years**.		9		7
8	**But Britain's population** is **still growing**.		5		1
9	**Where** are the **people going**?		3		2
10	**Answer**: to the **country**.		2		2
11	The **English countryside has** a **classic image**.		5		2
12	**People imagine** that **life** in the **country** is **slow** and **calm**; that there are **no traffic jams**, **no pollution**, and **no crime**.		13		9
13	In **some places**, **this** is **true**; **but** in **others** it is **not**.		7		5
Totals			**82**		**51**

7.13.1.3 Intonation direction

n	Intonation	Appropriate intonation (1)	Inappropriate intonation (0)
1	a future in the country? (↗)		
2	More and more people want to live the rural life (↘)		
3	... but (↗)…		
4	**city life is cool (↘)**		
5	**but is country life cooler? (↗)**		
6	**Apparently yes. (↘)**		
7	More and more people in Britain want to live in the country (↘),		
8	and this is causing more and more problems in some rural areas. (↘)		
9	The population of British cities has been falling for years (↘)		
10	Cities like Liverpool and Glasgow have lost about thirty percent of their population in thirty years (↘)		
11	**But Britain's population is still growing. (↗)**		
12	**Where are the people going? (↗)**		
13	**Answer: (↘) to the country. (↘)**		
14	The English countryside has a classic image (↘)		
15	People imagine that life in the country is slow and calm (↘);		
16	that there are no traffic jams (↘), no pollution, and no crime (↘)		
17	**In some places (↗)**		
18	**this is true (↘)**		
19	**but in others (↗)**		
20	**it is not. (↘)**		
	Totals		

7.13.2 Post-test: (Life on Mars?)

7.13.2.1 Syllable stress

n	Multisyllabic words	Word type	Correctly placed syllable stress (1)	Misplaced syllable stress (0)
1	**Ma**king	*noun*		
2	**pla**net	*noun*		
3	**rea**lly	*adverb*		
4	trans**form**	*verb*		
5	**fro**zen	*adjective*		
6	**sur**face	*noun*		
7	**in**to	*preposition*		
8	**som**ething	*pronoun*		
9	**frien**dly	*adjective*		
10	**hu**mans	*noun*		
11	**eq**ually	*adverb*		
12	im**por**tantly	*adverb*		
13	**ques**tion	*noun*		
14	**an**swer	*noun*		
15	**pro**bably	*sentence adverb*		
16	terra**for**ming	*verb*		
17	**pla**netary	*adjective*		
18	**scie**ntist	*noun*		
19	it**self**	*pronoun*		
20	**woul**dn't	*modal verb*		
21	**mo**dify	*verb*		
22	**at**mosphere	*noun*		
23	En**thu**siasts	*noun*		
24	**pre**sident	*noun*		
25	So**cie**ty	*noun*		

26	**Mar**tian	*adjective*		
27	**ci**ties	*noun*		
28	**en**gineer	*noun*		
29	be**lieves**	*verb*		
30	civili**za**tion	*noun*		
31	**can**not	*contraction (modal verb)*		
32	suc**ceed**	*verb*		
33	wi**thout**	*preposition*		
34	**li**mitless	*adjective*		
35	ex**pan**sion	*noun*		
36	**a**lso	*adverb*		
37	tran**sfor**med	*verb*		
38	**hor**rifying	*adjective*		
39	i**de**a	*noun*		
40	**ma**nage	*verb*		
41	**li**mited	*adjective*		
42	**be**tter	*adverb*		
43	**as**tronaut	*noun*		
44	**woul**dn't	*modal verb*		
45	**jou**rney	*noun*		
Totals				

7.13.2.2 Sentence stress

n	Sentences	Correct use	Content words (/108)	Correct use	Function words (/45)
1	**Life** on **Mars**?		2		1
2	**Making** the **red planet go*** **green**		5		1
3	**If** we **tried** to, **could** we really **transform** the **frozen surface** of **Mars** into **something** more **friendly**		9		8
4	– a **place** where **humans could live**?		4		2
5	And **equally importantly**, **should we**?		4		1
6	The **first question** has a **clear answer**: **Yes**, **we* probably could**.		8		3
7	**Most** of the **work** in '**terraforming**', **says NASA planetary scientist Chris McKay**, **would be done** by **life itself**.		14		4
8	'**We wouldn't** have to **build Mars**, **just modify** its **atmosphere**,' **McKay says**.		9		3
9	'**If we warmed** it up and **threw** in some **seeds**, **plants** would **grow there**.'		8		6
10	**Enthusiasts, such** as **Robert Zubrin**, **president** of the **Mars Society**, **dream** of **Martian cities**.		10		4
11	**Zubrin**, an **engineer**, **believes civilisation cannot succeed without** limitless **expansion**.		8		2
12	**He** also **thinks** that **if we transformed Mars** – a **horrifying idea** to **some** – **we might learn** to **manage** our **limited Earth better**.		16		6
13	**But if I was** an **astronaut**, **I wouldn't** be **keen** on that **six-month journey**!		11		4
	Totals		**108**		**45**

7.13.2.3 Intonation direction

n	Intonation	Appropriate intonation (1)	Inappropriate intonation (0)
1	Life on Mars? (↗)		
2	Making the red planet go green (↘)		
3	**If we tried to (↗),**		
4	could we really (↗) transform the frozen surface of Mars into something more friendly (↘)		
5	– a place where humans could live? (↘)		
6	And equally importantly (↘)		
7	**should we? (↗)**		
8	**The first question (↗)**		
9	**has a clear answer (↘)**		
10	**Yes (↘)**		
11	**we probably could (↘)**		
12	'We wouldn't have to build Mars (↘), just modify its atmosphere (↘),' McKay says (↘).		
13	**If we warmed it up (↗)**		
14	and threw in some seeds (↗)		
15	**plants would grow there.' (↘)**		
16	if we transformed Mars (↗)		
17	– a horrifying idea (↗) to some (↘)		
18	we might learn to manage limited Earth better (↘)		
19	**But if I was an astronaut (↗)**		
20	**I wouldn't be keen on that six-month journey! (↘)**		
	Totals		

7.14 Appendix 14. Inter-Coder Agreement Test

Informed consent

Your role in this study is to listen to 12 audio recordings and fill in the missing words. The audio recordings are of Algerian EFL students (aged between 18 and 23) and are presented in two activities, the first is about life in the countryside and the second is about creating life on the planet Mars.

The data generated in this online survey will be used as a part of a PhD thesis and other research publications. All the profile information you provide in this study will be encoded into the format of letters and numbers, and therefore you will not be identified as an individual in the final research. Moreover, the collected information will be securely stored and only the researcher and his supervisor will be able to access it.

For further information or inquiries about the study, please get in touch with the researcher through the following email address: **ma1106@york.ac.uk**

Thank you for taking the time to read this information.
Yours sincerely
Moustafa Amrate

Full name: …….
Date: …./…./……..
Signature: ……

Profile information for the research assistant

Please fill out the following profile information and then proceed with the listening activity.

Full name:	
Gender:	
Country of birth:	
Nationality:	
Mother tongue:	
Number of years learning English:	
Did you take the IELTS exam?	
If yes, what was your overall scores?	
If yes, what was your IELTS listening score?	
Do you have listening difficulties?	Yes ☐ No ☐
If yes, please specify:	

Inter-coder reliability test

1. Syllable stress: Listen to the following recordings carefully and underline the placement of syllable stress as pronounced by the speaker (i.e. student). **Example:** A future in the country? = A **fu/**ture in the **coun/**try?

Recording	Sentence
R1)	More and more **people (**peo/ple**)^2** want to live the **rural (**ru/ral**)^2** life... but...**city (**ci/ty**)^2** life is cool; but is **country (**coun/try**)^2** life **cooler (**coo/ler**)^2**? **Apparently (**A/ppa/rent/ly**)^4**, yes.
R2)	More and more **people (**peo/ple**)^2** in **Britain (**Bri/tain**)^2** want to live in the **country (**coun/try**)^2**, and this is **causing (**cau/sing**)^2** more and more **problems (**prob/lems**)^2** in some **rural (**ru/ral**)^2 areas (**a/reas**)^2**.
R3)	Life on Mars? **Making (**Ma/king**)^2** the red **planet (**pla/net**)^2** go green. If we tried to, could we really **transform (**trans/form**)^2** the **frozen (**fro/zen**)^2 surface (**sur/face**)^2** of Mars **into (**in/to**)^2 something (**some/thing**)^2** more **friendly (**friend/ly**)^2** – a place where **humans (**hu/mans**)^2** could live? And **equally (**e/qual/ly**)^3 importantly (**im/por/tant/ly**)^4**, should we?
R4)	The first **question (**ques/tion**)^2** has a clear **answer (**an/swer**)^2**: Yes, we **probably (**prob/a/bly**)^3** could. Most of the work in '**terraforming**' **(**ter/ra/form/ing**)^4**, says **NASA (**NA/SA**)^2 planetary (**plan/e/ta/ry**)^4 scientist (**sci/en/tist**)^3** Chris McKay, would be done by life **itself (**it/self**)^2**.

2. Sentence stress: Listen to the following recordings carefully and underline the placement of world stress as pronounced by the speaker. **Example:** A future in the country? = A **future** in the **country**?

Recording	Sentence
R1)	The population of British cities has been falling for years. Cities like Liverpool and Glasgow have lost about thirty percent of their population in thirty years.
R2)	But Britain's population is still growing. Where are the people going? Answer: to the country.
R3)	'We wouldn't have to build Mars, just modify its atmosphere,' McKay says. 'If we warmed it up and threw in some seeds, plants would grow there.'
R4)	Enthusiasts such as Robert Zubrin, president of the Mars Society, dream of Martian cities.

3. Intonation direction: Listen to the following recordings carefully and indicate the direction of sentence intonation as pronounced by the speaker (rising (↗), falling (↘)). **Example:** A future in the country? = ↗

Recording	Sentence	Intonation
R1)	The English countryside has a classic image.|[1] People imagine that life in the country is slow and calm;|[2] that there are no traffic jams,|[3] no pollution, and no crime.|[4]	1- 2- 3- 4-
R2)	In some places,|[1] this is true;|[2] but in others,|[3] it is not.|[4]	1- 2- 3- 4-
R3)	'We wouldn't have to build Mars,|[1] just modify its atmosphere,'|[2] McKay says.|[3] 'If we warmed it up|[4] and threw in some seeds,|[5] plants would grow there.'|[6]	1- 2- 3- 4- 5- 6-
R4)	He also thinks that if we transformed Mars|[1] – a horrifying idea to some –|[2] we might learn to manage our limited Earth better.|[3] But if I was an astronaut,|[4] I wouldn't be keen on that six-month journey!|[5]	1- 2- 3- 4- 5-

7.15 Appendix 15. Overall Comprehensibility Results

Pre-test						**Post-test**					
Collaborative CAPT group		**Individual CAPT group**		**Control group**		**Collaborative CAPT group**		**Individual CAPT group**		**Control group**	
Participants	**Score**	**Participants**	**Score**	**Participants**	**Score**	**Participants**	**Score**	**Participants**	**Score**	**Participants**	**Score**
Maria	5.67	Issam	5.67	Bilal	7.00	Maria	7.67	Issam	7.00	Bilal	4.33
Rym	6.33	Okba	6.67	Ismail	8.00	Rym	5.33	Okba	4.33	Ismail	5.00
Sarah	7.00	Marwa	5.00	Samiah	6.33	Sarah	5.67	Marwa	6.67	Samiah	4.67
Wafa	5.67	Esa	6.00	Farida	7.00	Wafa	5.00	Esa	7.00	Farida	8.67
Ikram	7.33	Riyadh	7.33	Nadia	6.33	Ikram	6.00	Riyadh	5.33	Nadia	5.00
Selma	8.33	Mourad	8.67	Imane	4.00	Selma	8.00	Mourad	7.33	Imane	7.67
Totals avgs	**6.72**	**Totals avgs**	**6.56**	**Totals avgs**	**6.44**	**Totals avgs**	**6.28**	**Totals avgs**	**6.28**	**Totals avgs**	**5.89**
SD	**0.95**	**SD**	**1.20**	**SD**	**1.23**	**SD**	**1.15**	**SD**	**1.08**	**SD**	**1.65**
Min	**5.67**	**Min**	**5.00**	**Min**	**4.00**	**Min**	**5.00**	**Min**	**4.33**	**Min**	**4.33**
Max	**8.33**	**Max**	**8.67**	**Max**	**8.00**	**Max**	**8.00**	**Max**	**7.33**	**Max**	**8.67**

7.16 Appendix 16. Prosodic Coding Results

7.16.1 Syllable stress

Pre-test														
Syllable stress results (/45)														
Collaborative CAPT group					**Individual CAPT group**					**Control group**				
Participants	**Correctly placed syllable stress** (/45)	**Correct ratio**	**Misplaced primary stress** (/45)	**Error ratio**	**Participants**	**Correctly placed syllable stress** (/45)	**Correct ratio**	**Misplaced primary stress** (/45)	**Error ratio**	**Participants**	**Correctly placed syllable stress** (/45)	**Correct ratio**	**Misplaced primary stress** (/45)	**Error ratio**
Maria	36	0.800	9	0.200	**Issam**	38	0.844	7	0.156	**Bilal**	41	0.911	4	0.089
Rym	33	0.733	12	0.267	**Okba**	38	0.844	7	0.156	**Ismail**	39	0.867	6	0.133
Sarah	41	0.911	4	0.089	**Marwa**	40	0.889	5	0.111	**Samiah**	38	0.844	7	0.156
Wafa	44	0.978	1	0.022	**Esa**	37	0.822	8	0.178	**Farida**	44	0.978	1	0.022
Ikram	38	0.844	7	0.156	**Riyadh**	38	0.844	7	0.156	**Nadia**	35	0.778	10	0.222
Selma	38.5	0.856	6.5	0.144	**Mourad**	39	0.867	6	0.133	**Imane**	39	0.867	6	0.133
Totals avgs	**38.41**	**0.854**	**6.58**	**0.146**	**Totals avgs**	**38.33**	**0.852**	**6.66**	**0.148**	**Totals avgs**	**39.33**	**0.874**	**5.66**	**0.126**
Post-test														
Syllable stress results (/45)														
Collaborative CAPT group					**Individual CAPT group**					**Control group**				
Participants	**Correctly placed syllable stress** (/45)	**Correct ratio**	**Misplaced primary stress** (/45)	**Error ratio**	**Participants**	**Correctly placed syllable stress** (/45)	**Correct ratio**	**Misplaced primary stress** (/45)	**Error ratio**	**Participants**	**Correctly placed syllable stress** (/45)	**Correct ratio**	**Misplaced primary stress** (/45)	**Error ratio**
Maria	39	0.867	6	0.133	**Issam**	38	0.844	7	0.156	**Bilal**	39	0.867	6	0.133
Rym	40	0.889	5	0.111	**Okba**	36	0.800	9	0.200	**Ismail**	38	0.844	7	0.156
Sarah	43	0.956	2	0.044	**Marwa**	40	0.889	5	0.111	**Samiah**	38	0.844	7	0.156
Wafa	42	0.933	3	0.067	**Esa**	40	0.889	5	0.111	**Farida**	39	0.867	6	0.133
Ikram	39	0.867	6	0.133	**Riyadh**	41	0.911	4	0.089	**Nadia**	40	0.889	5	0.111
Selma	39	0.867	6	0.133	**Mourad**	39	0.867	6	0.133	**Imane**	39	0.867	6	0.133
Totals avgs	**40.33**	**0.896**	**4.66**	**0.104**	**Totals avgs**	**39**	**0.867**	**6**	**0.133**	**Totals avgs**	**38.83**	**0.863**	**6.17**	**0.137**

7.16.2 Sentence stress

Sentence stress results (/133)														
Pre-test														
Collaborative CAPT group					**Individual CAPT group**					**Control group**				
Participants	**Correctly placed stress (133)**	**Correct stress placement ratio**	**Total errors in pronunciation**	**Error ratio**	**Participants**	**Correctly placed stress (133)**	**Correct stress placement ratio**	**Total errors in pronunciation**	**Error ratio**	**Participants**	**Correctly placed stress (133)**	**Correct stress placement ratio**	**Total errors in pronunciation**	**Error ratio**
Maria	124	0.932	9	0.068	Issam	122	0.917	11	0.083	Bilal	130.000	0.977	3.000	0.023
Rym	122	0.917	11	0.083	Okba	124	0.932	9	0.068	Ismail	127.000	0.955	6.000	0.045
Sarah	130	0.977	3	0.023	Marwa	127	0.955	6	0.045	Samiah	125.000	0.940	8.000	0.060
Wafa	130	0.977	3	0.023	Esa	118	0.887	15	0.113	Farida	130.000	0.977	3.000	0.023
Ikram	124	0.932	9	0.068	Riyadh	126	0.947	7	0.053	Nadia	130.000	0.977	3.000	0.023
Selma	126	0.947	7	0.053	Mourad	127	0.955	6	0.045	Imane	128.000	0.962	5.000	0.038
Totals avgs	126	0.947	7	0.053	**Totals avgs**	124	0.932	9	0.068	**Totals avgs**	128.333	0.965	4.667	0.035
Sentence stress results (/13)														
Post-test														
Collaborative CAPT group					**Individual CAPT group**					**Control group**				
Participants	**Correctly placed stress (153)**	**Correct stress placement ratio**	**Total errors in pronunciation**	**Error ratio**	**Participants**	**Correctly placed stress (153)**	**Correct stress placement ratio**	**Total errors in pronunciation**	**Error ratio**	**Participants**	**Correctly placed stress (153)**	**Correct stress placement ratio**	**Total errors in pronunciation**	**Error ratio**
Maria	143	0.935	10	0.065	Issam	140	0.915	13	0.085	Bilal	149	0.974	4	0.026
Rym	148	0.967	5	0.033	Okba	147	0.961	6	0.039	Ismail	144	0.941	9	0.059
Sarah	148	0.967	5	0.033	Marwa	149	0.974	4	0.026	Samiah	143	0.935	10	0.065
Wafa	150	0.980	3	0.020	Esa	145	0.948	8	0.052	Farida	146	0.954	7	0.046
Ikram	147	0.961	6	0.039	Riyadh	146	0.954	7	0.046	Nadia	146	0.954	7	0.046
Selma	140	0.915	13	0.085	Mourad	151	0.987	2	0.013	Imane	145	0.948	8	0.052
Totals avgs	146	0.954	7	0.046	**Totals avgs**	146.333	0.956	6.66667	0.044	**Totals avgs**	145.5	0.951	7.5	0.049

7.16.3 Intonation direction

Pre-test														
Intonation results (/20)														
Collaborative CAPT group					**Individual CAPT group**					**Control group**				
Participants	**Correct intonation**	**Correct intonation ratio**	**Inappropriate intonation**	**Inappropriate intonation ratio**	**Participants**	**Correct intonation**	**Correct intonation ratio**	**Inappropriate intonation**	**Inappropriate intonation ratio**	**Participants**	**Correct intonation**	**Correct intonation ratio**	**Inappropriate intonation**	**Inappropriate intonation ratio**
Maria	15	0.750	5	0.25	**Issam**	14	0.700	6	0.300	**Bilal**	15	0.750	5	0.250
Rym	15.5	0.775	4.5	0.225	**Okba**	16	0.800	4	0.200	**Ismail**	14.5	0.725	5.5	0.275
Sarah	16	0.800	4	0.2	**Marwa**	16	0.800	4	0.200	**Samiah**	15.5	0.775	4.5	0.225
Wafa	17	0.850	3	0.15	**Esa**	15.5	0.775	4.5	0.225	**Farida**	16.5	0.825	3.5	0.175
Ikram	14	0.700	6	0.3	**Riyadh**	14	0.700	6	0.300	**Nadia**	16	0.800	4	0.200
Selma	16	0.800	4	0.2	**Mourad**	15.5	0.775	4.5	0.225	**Imane**	14.5	0.725	5.5	0.275
Total avgs	15.58	0.779	4.41	0.220	**Totals avgs**	15.16	0.758	4.83	0.241	**Totals avgs**	15.33	0.766	4.66	0.233
Post-test														
Intonation results (/20)														
Collaborative CAPT group					**Individual CAPT group**					**Control group**				
Participants	**Correct intonation**	**Correct intonation ratio**	**Inappropriate intonation**	**Inappropriate intonation ratio**	**Participants**	**Correct intonation**	**Correct intonation ratio**	**Inappropriate intonation**	**Inappropriate intonation ratio**	**Participants**	**Correct intonation**	**Correct intonation ratio**	**Inappropriate intonation**	**Inappropriate intonation ratio**
Maria	16.25	0.813	3.75	0.188	**Issam**	15.00	0.750	5.00	0.250	**Bilal**	15.5	0.775	4.50	0.225
Rym	16.00	0.800	4.00	0.200	**Okba**	16.75	0.838	3.25	0.163	**Ismail**	16	0.800	4.00	0.200
Sarah	17.75	0.888	2.25	0.113	**Marwa**	18.25	0.913	1.75	0.088	**Samiah**	16.25	0.813	3.75	0.188
Wafa	16.75	0.838	3.25	0.163	**Esa**	15.25	0.763	4.75	0.238	**Farida**	16.5	0.825	3.50	0.175
Ikram	16.25	0.813	3.75	0.188	**Riyadh**	17.25	0.863	2.75	0.138	**Nadia**	15.25	0.763	4.75	0.238
Selma	14.50	0.725	5.50	0.275	**Mourad**	19.00	0.950	1.00	0.050	**Imane**	16.75	0.838	3.25	0.163
Total avgs	**16.25**	**0.813**	**3.75**	**0.188**	**Totals avgs**	**16.91**	**0.846**	**3.08**	**0.154**	**Totals avgs**	**16.04**	**0.802**	**3.95**	**0.198**

7.17 Appendix 17. Prosodic Error Ratio

7.17.1 Collaborative CAPT group

Pre-test						Post-test					
Participants	**Syllable stress**	**Intonation direction**	**Sentence stress**	**Error ratio**	**SD**	**Participants**	**Syllable stress**	**Intonation direction**	**Sentence stress**	**Error ratio**	**SD**
Maria	0.200	0.250	0.068	0.173	0.077	Maria	0.133	0.188	0.065	0.129	0.050
Rym	0.267	0.225	0.083	0.191	0.079	Rym	0.111	0.200	0.033	0.115	0.068
Sarah	0.089	0.200	0.023	0.104	0.073	Sarah	0.044	0.113	0.033	0.063	0.035
Wafa	0.022	0.150	0.023	0.065	0.060	Wafa	0.067	0.163	0.020	0.083	0.059
Ikram	0.156	0.300	0.068	0.174	0.096	Ikram	0.133	0.188	0.039	0.120	0.061
Selma	0.144	0.200	0.053	0.132	0.061	Selma	0.133	0.275	0.085	0.164	0.081
Totals avgs	**0.146**	**0.221**	**0.053**	**0.140**	**0.069**	**Totals avgs**	**0.104**	**0.188**	**0.046**	**0.112**	**0.058**
SD	**0.078**	**0.047**	**0.023**	**0.045**		**SD**	**0.036**	**0.048**	**0.022**	**0.032**	
Min	**0.022**	**0.150**	**0.023**	**0.065**		**Min**	**0.044**	**0.113**	**0.020**	**0.063**	
Max	**0.267**	**0.300**	**0.083**	**0.191**		**Max**	**0.133**	**0.275**	**0.085**	**0.164**	
Totals	**0.140**					Totals	**0.112**				

7.17.2 Individual CAPT group

Pre-test						Post-test					
Participants	**Syllable stress**	**Intonation direction**	**Sentence stress**	**Error ratio**	**SD**	**Participants**	**Syllable stress**	**Intonation direction**	**Sentence stress**	**Error ratio**	**SD**
Issam	0.156	0.300	0.083	0.179	0.090	Issam	0.156	0.250	0.085	0.164	0.068
Okba	0.156	0.200	0.068	0.141	0.055	Okba	0.200	0.163	0.039	0.134	0.069
Marwa	0.111	0.200	0.045	0.119	0.063	Marwa	0.111	0.088	0.026	0.075	0.036
Esa	0.178	0.225	0.113	0.172	0.046	Esa	0.111	0.238	0.052	0.134	0.077
Riyadh	0.156	0.300	0.053	0.169	0.101	Riyadh	0.089	0.138	0.046	0.091	0.037
Mourad	0.133	0.225	0.045	0.134	0.073	Mourad	0.133	0.050	0.013	0.065	0.050
Totals avgs	**0.148**	**0.242**	**0.068**	**0.152**	**0.071**	**Totals avgs**	**0.133**	**0.154**	**0.044**	**0.110**	**0.048**
SD	**0.021**	**0.042**	**0.024**	**0.022**		**SD**	**0.036**	**0.073**	**0.023**	**0.036**	
Min	**0.111**	**0.200**	**0.045**	**0.119**		**Min**	**0.089**	**0.050**	**0.013**	**0.065**	
Max	**0.178**	**0.300**	**0.113**	**0.179**		**Max**	**0.200**	**0.250**	**0.085**	**0.164**	
Totals	**0.152**					**Totals**	**0.110**				

7.17.3 Control group

Pre-test						Post-test					
Participants	**Syllable stress**	**Intonation direction**	**Sentence stress**	**Error ratio**	**SD**	**Participants**	**Syllable stress**	**Intonation direction**	**Sentence stress**	**Error ratio**	**SD**
Bilal	0.089	0.250	0.023	0.120	0.096	Bilal	0.133	0.225	0.026	0.128	0.081
Ismail	0.133	0.275	0.045	0.151	0.095	Ismail	0.156	0.200	0.059	0.138	0.059
Samiah	0.156	0.225	0.060	0.147	0.068	Samiah	0.156	0.188	0.065	0.136	0.052
Farida	0.022	0.175	0.023	0.073	0.072	Farida	0.133	0.175	0.046	0.118	0.054
Nadia	0.222	0.200	0.023	0.148	0.089	Nadia	0.111	0.238	0.046	0.131	0.080
Imane	0.133	0.275	0.038	0.149	0.098	Imane	0.133	0.163	0.052	0.116	0.047
Totals avgs	**0.126**	**0.233**	**0.035**	**0.131**	**0.081**	**Totals avgs**	**0.137**	**0.198**	**0.049**	**0.128**	**0.061**
SD	**0.061**	**0.037**	**0.014**	**0.028**		**SD**	**0.015**	**0.026**	**0.012**	**0.008**	
Min	**0.022**	**0.175**	**0.023**	**0.073**		**Min**	**0.111**	**0.163**	**0.026**	**0.116**	
Max	**0.222**	**0.275**	**0.060**	**0.151**		**Max**	**0.156**	**0.238**	**0.065**	**0.138**	
Totals	**0.131**					Totals	**0.128**				

7.18 Appendix 18. Learning Log Samples

7.18.1 Learning log sample (Collaborative CAPT group)

LEARNING LOG (Pilot study)

Full name: Rym (collaborative group)
Date: 09/11/2016

How do you rate today's session?

Please **circle** one answer and briefly **explain it**

I liked the session very much	I liked the session	I don't know	I didn't like the session	I didn't like the session at all

Please explain here: I Liked the Method of computer Program to help us in The sentence intonation.

Did you learn anything from today's session?

Pease, **circle** one answer and briefly **explain it**

YES	NO
If YES, please state what you learned: The important of intonation to indicate What the speaker means and where he/she Put emphasis on.	If NO; what prevented you from learning?

Did the **computer program** help you learn anything about today's lesson?

Please, **circle** one answer and briefly **explain it**

YES	NO
If YES, please explain: - The computer Program teach and/or correct the intonation mistakes because we sometimes don't focus on the intonation; however, it shows the situation of the Speaker.	If NO, Why?

Would you like to learn about today's topic?

Please, **circle** one answer and briefly **explain it**

YES	NO
If YES, please explain: - The exclusive focus on "sentence intonation" - The importance of "Computer Program" to evaluate our Level.	If NO, Why?

7.18.2 Learning log sample (Collaborative CAPT group)

LEARNING LOG (Pilot study)

Full name: Maria (collaborative group)
Date: 18/12/2015

How do you rate today's session?
Please **circle** one answer and briefly **explain it**

I liked the session very much	I liked the session	I don't know	I didn't like the session	I didn't like the session at all

Please explain here:
- We learn about stress which is very important while speaking

Did you learn anything from today's session?
Pease, **circle** one answer and briefly **explain it**

YES	NO
If YES, please state what you learned: - the place of stress in some sentences	If NO; what prevented you from learning?

Did the **computer program** help you learn anything about today's lesson?
Please, **circle** one answer and briefly **explain it**

YES	NO
If YES, please explain: - yes. I likes the program and I like the way it shows us the place of the stress.	If NO, Why?

Would you like to learn about today's topic?
Please, **circle** one answer and briefly **explain it**

YES	NO
If YES, please explain: yes. I would to learn much about the stress because of it's importance in speaking to express the meaning.	If NO, Why?

7.18.3 Learning log sample (Individual CAPT group)

LEARNING LOG (Pilot study)

Full name: Okba (Individual group)
Date: 1.8.2016

How do you rate today's session?

Please **circle** one answer and briefly **explain it**

I liked the session very much	I liked the session	I don't know	I didn't like the session	I didn't like the session at all
✓				

Please explain here:
It was much better then the 1.st one cause I feel that each time we rise the level we learn more.

Did you learn anything from today's session?

Pease, **circle** one answer and briefly **explain it**

YES ✓	NO
If YES, please state what you learned: We learn how can the pronunciation of one word change the whole meaning	If NO; what prevented you from learning?

Did the **computer program** help you learn anything about today's lesson?

Please, **circle** one answer and briefly **explain it**

YES ✓	NO
If YES, please explain: It help me to concentrate one need key words on each sentence	If NO, Why?

Would you like to learn about today's topic?

Please, **circle** one answer and briefly **explain it**

YES ✓	NO
If YES, please explain: I would always like to keep improving myself on this topic so I can speak clearly.	If NO, Why?

7.18.4 Learning log sample (Individual CAPT group)

LEARNING LOG (Pilot study)

Full name: Marwa (Individual group)
Date: .....

How do you rate today's session?

Please **circle** one answer and briefly **explain it**

I liked the session very much ✓	I liked the session	I don't know	I didn't like the session	I didn't like the session at all

Please explain here:
yeah, I really do because it was fruitful

Did you learn anything from today's session?

Please, **circle** one answer and briefly **explain it**

YES	NO
If YES, please state what you learned: I have learned the correct pronunciation of many words	If NO; what prevented you from learning?

Did the **computer program** help you learn anything about today's lesson?

Please, **circle** one answer and briefly **explain it**

YES	NO
If YES, please explain: I found it beneficial - it is detailed and can improve your reading and listening skills	If NO, Why?

Would you like to learn about today's topic?

Please, **circle** one answer and briefly **explain it**

YES	NO
If YES, please explain: yes, I want to know more about sentence Rhythm Because I would learn more about the stce structure and on which part should I emphasis.	If NO, Why?

Abbreviations and Acronyms

ASR:	Automatic speech recognition
CALL:	Computer-assisted language learning
CAPT:	Computer-assisted pronunciation training
CMC:	Communicative mediated communication
EFL:	English as a foreign language
ESL:	English as a second language
L2:	Second language
MSA:	Modern standard Arabic
MA:	Master of Arts
BA:	Bachelor of arts
BAC:	Baccalaureate exam
PEU:	Perceived ease of use
PU:	Perceived usefulness
UI:	User interface
IELTS:	International English language testing system
S-S:	Student-student
SCT	Sociocultural theory
Rep:	Number of repeated sentences
Avg:	Average repetition of sentence
Skip:	Number of skipped sentences
NS:	Native speaker
NNS:	Non-native speaker

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