Exploring the psychological and sociological factors affecting critical thinking with students of English for Academic Purposes, using the topic of climate change

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Declaration

I, the author, confirm that the Thesis is my own work. I am aware of the University's Guidance on the Use of Unfair Means (www.sheffield.ac.uk/ssid/unfair-means). This work has not previously been presented for an award at this, or any other, university.

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Abstract

Higher education students in the UK and elsewhere are expected to display critical thinking. Critical thinking may be impeded by psychological and sociological factors such as: belief and confirmation biases, framing, social pressure to conform, and poor assessment of probability and risk: factors which also hinder action on climate change. Although some studies suggest that raising awareness of biases improves critical thinking, none to my knowledge has examined the effects of systematically exploring these factors with students of English for Academic Purposes (EAP). The aim of my research, for which I took an interpretivist stance, was to discover the impact of such an exploration on EAP students' concept of critical thinking, and on their own critical thinking as they perceived it. I ran workshops for EAP students at the University of Sheffield focusing on each of the above factors, using climate change as a topic, and then interviewed the participants. The resulting data was analysed using thematic analysis and code development.

Participants reported an improved understanding of the skills of questioning and analysing, using multiple perspectives, and argument building; and new awareness of confirmation bias, the use of evidence and sources, framing, independent thinking and culture in relation to critical thinking. There was also evidence of development in critical dispositions relating to the self (such as self-awareness) and to other people (such as respect for others' views), and in criticality in their response to climate change. My study suggests that EAP students may find their understanding and practice of critical thinking benefits from learning about how it can be affected by psychological and sociological factors. The role of EAP teachers might therefore extend beyond an instrumental focus on specific critical thinking skills needed to complete academic tasks, towards the fostering of critical thinking dispositions and criticality in their students.

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1. Introduction

1.1 Rationale for the research

I have been teaching English for Academic Purposes (EAP) at the English Language Teaching Centre (ELTC) at the University of Sheffield since 2001, and so have chosen this area of education for my research project. EAP teaching "aims to prepare students for the language and learning demands of study in higher education" (Wilson, 2019, p. 3), and so covers not only language, but also study skills and critical thinking. EAP programmes support students of all disciplines pursuing degree courses from undergraduate to doctoral level at English-medium universities (Ding and Bruce, 2017). Most people studying EAP are international students whose first language is not English, although home students and those whose first language is English may also benefit from EAP provision (Northcott, 2019). The term "EAP students" therefore denotes a diverse group, with the pursuit of higher education in common.

Students of all disciplines at British universities (such as Sheffield) must display critical thinking of some kind (see the Literature Review, pp. 11-15) to succeed in their degree courses. International students from different educational systems may also have to adjust to the expectations and norms of their new academic environment (Tian and Low, 2011). This is why I have focused on concepts of critical thinking prevalent in what I have termed "the West" in this thesis, that is, Europe, North America (Cambridge Dictionary, 2020b) and countries with similar education traditions. (See the Literature Review, pp. 30-32, for a further discussion of critical thinking in different cultures).

In my experience, many EAP students are concerned about meeting the critical thinking requirements of their degree courses. Developing critical thinking is not only part of the EAP teacher's remit (Moore, 2019), but may also contribute to the "graduate attributes" claimed by many universities (Howe, 2016). Critical thinking is also thought to benefit society as a whole (Ten Dam and Volman, 2004). As well as an EAP teacher, I am a climate change activist with a particular interest in the psychology of climate change. This led me to study the factors that influence all human thinking, including critical thinking, as explained in

the section on my positionality in the Methodology chapter; I thought that students might benefit from exploring these factors in their endeavours to become better critical thinkers.

I used the topic of climate change (amongst others) in this exploration because it illustrates certain factors which affect critical thinking; because of its relevance to many disciplines across the sciences, social sciences and humanities; and because of its global importance now (see the Methodology chapter, p. 49). I also wanted to know how students' perceptions of climate change might be influenced by exposure to new information and perspectives. My intention, however, was not to "convert" participants to my view of climate change, or to change their behaviour.

I located my study at the ELTC so I could work with the kind of students I usually teach; this would not only inform my own future teaching, but enable me to disseminate any useful findings to my colleagues. However, I hope these findings will also be of use to any teacher whose role includes guiding higher education students on their critical thinking journey.

1.2 Critical thinking, higher education and EAP

In Western countries such as the UK, critical thinking is traditionally considered to be a social good (Cowden and Singh, 2015), and particularly necessary for a properly functioning democracy (Brookfield, 2015; Volman and ten Dam, 2015). Ten Dam and Volman (2004) describe it as "a crucial aspect of the competence citizens need to participate in society" (p. 359). In the West, the development of critical thinking is at "the heart of education" (Facione, 1990), particularly of higher education (Davies and Barnett, 2015). Although there are many definitions of critical thinking (Moore, 2019), Ennis's "reasonable, reflective thinking that is focused on deciding what to believe or do" is often quoted (2015, p. 32). Critical thinking is expected of university students whatever they are studying, although different disciplines may emphasize different aspects of critical thinking (as discussed in the Literature Review).

International students now make up a large part of the student population in many English-speaking countries, including the UK (Coate, 2009; Humfrey, 2011; Marginson, 2006; Rizvi and Lingard, 2010), where they provide a vital income stream for universities (Naidoo, Shankar and Veer, 2011). Most of the international students in Britain come from non-

English speaking countries (Higher Education Statistics Agency [HESA], 2020), and their language skills are not always up to the level expected by their tutors and lecturers (Carroll, 2005; Minsky, 2016). This has led to a significant expansion in the field of teaching English for Academic Purposes (Ding and Bruce, 2017).

As mentioned above, the aim of English for Academic Purposes is to prepare students for tertiary education (Wilson, 2019). EAP focuses on language skills required for academic tasks such as essay writing, formal presentations or seminar discussion, in which students (including home students) may lack the necessary levels of proficiency. They cannot succeed at these tasks without critical thinking. Moore (2019, p. 2) argues that "[c]ritical thinking is a key element of academic study and for this reason needs to be included as part of English for Academic Purposes (EAP) curricula".

International students are often criticised by their tutors for failing to display the critical thinking skills required in their assignments (Bali, 2015; Dong, 2015; Manalo, Kusumi, Koyasu, Michita and Tanaka, 2015; Tian and Low, 2011); this is consistent with my own experience of supporting such students. Some academics believe that international students, particularly those from Asia, find critical thinking difficult because of their educational background (Atkinson, 1997; Norris, 1995; Robertson, Line, Jones and Thomas, 2000), although this has been disputed (Paton, 2005; Stapleton, 2002). Most non-EU students come to the UK to study postgraduate taught degrees, and so are moving up to the next level of tertiary education (HESA, 2020), which presents cognitive challenges of its own. However, my belief is that critical thinking does not come easily to anyone, whatever their background, nationality or level of education. As van Gelder claims, "critical thinking is hard … and most people are just not very good at it" (2005, p. 42).

1.3 Critical thinking and climate change

Van Gelder's claim seems to be borne out by the fact that human beings often act in ways that do not seem to be based on Ennis's "reasonable, reflective thinking that is focused on deciding what to believe or do" (2015, p. 32). People buy lottery tickets that will almost certainly not win (lottery.co.uk, 2020), invest their life savings in businesses that are likely to fail (Kahneman, 2011), choose political leaders on the basis of their persona rather than

their policies or record (Evans, 2010), and believe conspiracy theories that seem to have no basis in known fact, for example about Covid-19 (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2020).

However, of all human failures to employ reasonable and reflective thinking, climate change is arguably the worst (United Nations [UN], 2020). The scientific consensus that climate change is serious, urgent and man-made is overwhelming (National Aeronautics and Space Administration [NASA], 2020), and we have known about it for decades (United Nations Framework Convention on Climate Change [UNFCCC], 2015). We have already seen its effects in the form of extreme weather events such as heatwaves, droughts, floods, rising sea levels, ocean acidification, and damage to ecosystems; the risks to humans of food insecurity and climate migration are already evident (Met Office, n.d.). Strategies to reduce greenhouse gas emissions, including changes in energy production, land use, food production and urban planning, have resulted from thorough research by climate scientists, whose recommendations are presented to the world at regular intervals (Intergovernmental Panel on Climate Change [IPCC], 2014a). Yet emissions continue to rise (IPCC, 2014a; Le Page, 2017).

Why are we in this situation?

Although climate change is an existential threat to human civilisation (Schellnhuber, 2013, cited in Marshall, 2014; Thompson, 2010), action is hindered by common attitudes such as denial, apathy, trivialisation and cognitive dissonance (Marshall, 2014). Research by psychologists and sociologists throws light on the factors at play. These factors will be explored in the Literature Review, and include belief bias and confirmation bias (Kahneman, 2011), framing (Toplak, West and Stanovich, 2013), the influence of peer pressure (Norgaard, 2009) and group affiliation (Rabinovich, Morton, Postmes and Verplanken, 2012), and poor assessment of probability and risk (Evans, 2010; Kahneman, 2011).

These psychological and sociological factors affect not only attitudes to climate change, but human thought processes in general, creating potential barriers to critical thinking, such as biases (Stanovich and West, 2008; Toplak et al., 2013; van Gelder, 2005; West, Toplak and Stanovich, 2008). (Note that I am not linking critical thinking to environmental attitudes in *individuals*, but the ways we have evolved to think with humanity's *collective* failure to

tackle climate change, as discussed in the Literature Review). Higher education students might be expected to benefit from developing an understanding of their own thought processes to avoid these biases (Battersby and Bailin, 2013; Kenyon, 2014; van Gelder, 2005). In addition, higher education should, arguably, produce graduates whose lives and work will benefit society (Howe, 2016). Many social problems are exacerbated by the polarisation of opinion, recent examples including Brexit in the UK (Hobolt, Leeper and Tilley, 2020), support for Donald Trump in the US (Pew Research Centre, 2020) and climate change itself, in several countries (Marshall, 2014) and on the internet (van Eck, Mulder and Dewulf, 2020). It seems that people often do not listen to each other, and when they do, they do not understand. So graduates also need empathy, and to understand why others hold the views they do.

1.4 Critical thinking and understanding the human mind

Critical thinking in EAP tends to be pragmatic (Dudley-Evans, in Benesch, 2001) and oriented narrowly towards the kinds of tasks students must complete in their academic studies (Moore, 2019). Although this preparation is of course necessary, I would argue, for the reasons given above, that a purely instrumental approach to critical thinking is insufficient to equip students for their role as global citizens. For critical thinking instruction to play a part in this preparation, it must include an understanding of how the human mind works, one's own as well as the minds of other people. Metacognition, in the sense of awareness and conscious direction of one's own thought processes, is thought to be necessary to critical thinking, as discussed in the Literature Review (Efklides, 2008; Kuhn, 1999; Maclellan and Soden, 2011; Sadeghi, Hassani and Rahmatkhah, 2014). There is also evidence that raising awareness of common biases can help students to avoid them, to the benefit of their critical thinking development (Battersby and Bailin, 2013; Correia, 2016; Heiltjes, van Gog and Pass, 2014; Kenyon, 2014; Macpherson and Stanovich, 2007). Tanaka and Gilliland (2016) argue that "CT [critical thinking] instruction should go beyond skills to engage students with identifying their own biases" (p. 1), and in their study they attempt to achieve this by encouraging students to consider multiple viewpoints on contentious issues. However, neither this, nor any other study I have found, systematically explores with EAP

students the various psychological and sociological factors affecting critical thinking, as described above, to see if this has any effect on their critical thinking,

Students themselves have the most intimate understanding of changes in their own thinking. So it seems disrespectful for me as a researcher to assume that I can infer anything about such changes without asking participants for their perspectives. This has led me to adopt an interpretivist stance for my research project, as detailed in the Methodology chapter.

1.5 Research aims

The aim of this study, therefore, is to find out whether students feel that exploring critical thinking at a deeper level, by learning about the psychological and sociological factors that influence it, is beneficial to the development of their own critical thinking. To do this, the participants' initial concept of critical thinking must be ascertained, as well as any changes to this concept as a result of the exploration of the target factors. Climate change is a particularly suitable vehicle to explore these factors, because (as explained in the Methodology chapter) this issue is relevant to a wide range of the disciplines that EAP students pursue, and also because it is a global problem of the kind that university graduates might be expected to engage with as "active agents of social good" (Howe, 2016). Indeed, it is "the defining issue of our time" (United Nations [UN], 2020).

These, then, are my research questions:

1. What do EAP students understand by "critical thinking"?
2. Does exploring psychological and sociological factors which influence human thinking in workshops affect students' perceptions of what constitutes critical thinking? If so, how?
3. Do students feel that exploring these factors in workshops has an impact on their own critical thinking, and if so, how?
4. Does using the topic of climate change in such workshops change students' perceptions of the issue, and if so, how?

My research project was carried out at the English Language Teaching Centre (ELTC) at the University of Sheffield, where I work, and so was confined to EAP students studying there. These were either pre-sessional students studying English full-time in preparation for their postgraduate degrees, or in-sessional students who had already entered their departments. Most of my participants (16 out of 23) were Chinese, as this nationality makes up the vast majority of students at ELTC, and were drawn from a mix of disciplines and epistemic traditions. As my participants were volunteers attending my critical thinking course in their own time, the workshops were necessarily limited in length and number. In brief, I designed a course of six workshops, each of which covered one factor or area relevant to critical thinking (as described in the Methodology chapter), and I ran this course once in each of the three terms in the calendar year 2019, before interviewing the participants.

In the next chapter, the Literature Review, I consider different conceptualisations of critical thinking, the role of EAP teachers in developing it, and the effectiveness of exploring psychological and sociological factors which affect critical thinking, before defining the research gap I intend to fill in this study. This is followed by the Methodology chapter, in which I discuss my epistemology, positionality and choice of methods for data generation and analysis, as well as the ethical considerations of my project. In the fourth chapter, I analyse my findings and consider how these might answer each of my research questions. I then examine the changes I perceived in the participants' understanding of critical thinking, consider the influence of culture, and explore the concept of critical thinking as a process in the Discussion chapter. In the Conclusion, I outline the contribution of my research to the field and its implications for practice and policy, the impact on my personal learning and development, and the study's limitations, before suggesting recommendations for further research.

2. Literature Review.

2.1 Introduction

In this literature review, I will examine three models of critical thinking relevant to my study; skills (the traditional focus of EAP); dispositions (the development of which is arguably the aim of my participants' university education) and criticality (which concerns students' engagement with social and global issues such as climate change, the main topic of the workshops in my research project). I will then discuss human factors affecting critical thinking, and how exploring them might benefit the participants in my study. As my participants are from Asia or the Middle East, there will also be a discussion of possible differences in concepts of critical thinking and attitudes to climate change in non-Western cultures. Finally, I will delineate the research gap that this study aims to fill. As mentioned in the Introduction, no study to date has examined the effect on EAP students of raising awareness of the psychological and sociological factors that impact critical thinking.

First, I will first review some conceptualisations of critical thinking and the role of EAP teachers in developing critical thinking in their students.

2.2 Conceptualisations of critical thinking

Higher education students in the UK and other Western countries are expected to be good critical thinkers (Davies, 2013; Davies and Barnett, 2015; Ennis, 2015; Moore, 2011). However, critical thinking is notoriously difficult to define satisfactorily. The American Philosophical Association's definition of critical thinking is often cited:

> [It is] purposeful, self-regulatory judgement which results in interpretation, analysis, evaluation and inference as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgement is based. CT [critical thinking] is essential as a tool of inquiry. As such CT is a liberating force in education and a powerful resource in one's personal and civic life … The ideal critical thinker is habitually inquisitive, well informed, trustful of reason, open-minded, flexible, fair-minded in evaluation … [and] honest in facing personal biases (Facione, 1990, p. 2).

This more concise definition from Ennis (2015, p. 32) is also popular: "[c]ritical thinking is reasonable, reflective thinking that is focused on deciding what to believe or do". Ennis's

and Facione's definitions cover: critical thinking activities, the ability to perform which we may call *skills*; the *characteristics* of a critical thinker; and *actions* which are informed by critical thinking, as a citizen or as a private individual. These three aspects are discussed by Davies and Barnett (2015), who call them the "skills-and-judgements" view (p. 11), the "skills-plus-dispositions" view (p. 13), and the "criticality" or "skills-plus-dispositions-plus-actions" view (p. 14); each of which builds on the last.

The "skills and judgements' view" involves reflection and forming judgements. In this model, critical thinking is described as "a 'higher-order skill', that is, a complex activity built up out of [sic] other skills that are simpler and easier to acquire" (van Gelder, 2005, p. 42). The "skills-plus-dispositions" view is that critical thinking also requires the characteristics that would predispose a person to use such skills. Facione's "inquisitive" habits or "honest[y] in facing personal biases" might be among these dispositions (1990, p. 2). According to Davies and Barnett (2015, p. 15), the third view, "criticality", includes "three things, thinking, being and acting" and is concerned not only with the individual, but their place in society and the world. Criticality "can prompt students to understand themselves, to have a critical orientation to the world, and to demonstrate an active socio-political stance towards established norms and practices" (p. 16). These three views of critical thinking overlap somewhat, as discussed later in the chapter.

2.3 The role of EAP teachers in developing critical thinking

There is some debate about the boundaries of the EAP teacher's remit, although this generally includes the development of critical thinking under at least one of Davies and Barnett's three models (2015). The traditional role of teachers of English for Academic Purposes, in the UK and elsewhere, is to prepare students for academic study by teaching them the appropriate language and study skills, so serving both their own needs and those of their academic departments. Taking EAP to be a branch of English for Specific Purposes [ESP], Dudley-Evans notes:

> ESP practice has … remained essentially pragmatic … priority has been given to discovering the expectations of the academic or professional community of which the students of the ESP class aspire to become full members and then reducing that information to teachable units (Dudley-Evans, in Benesch 2001, p. ix).

Although Dudley-Evans does not specifically mention them, it seems likely that the "teachable units" of critical thinking would be conceived as discrete skills such as, for example "analysing claims" or "evaluating arguments" (Davies and Barnett, 2015, p. 12), rather than as elements of disposition or criticality. In this *pragmatic* approach to EAP, the teacher might be expected to help students develop the critical thinking skills necessary for such language-based activities as writing essays or participating in seminars.

However, Raimes, Morgan and others argue that the EAP professional should not be expected to adopt a "butler's stance" (Raimes, 1991, p. 243, cited in Benesch, 2001, p. 38) or act as mere "technician" in the service of academics who are thought to do the real business of higher education (Morgan, 2009, p. 88), but should play a substantial part in students' intellectual development. Furthermore, proponents of *critical* EAP, such as Benesch (2001), Pennycook (1997) and Phillipson (1992), oppose the pragmatic stance outlined by Dudley-Evans by seeking to support students in challenging the norms and conventions of the academy rather than simply encouraging students to conform to them. Critical EAP "is concerned with '*critiquing* existing educational institutions and practices, and subsequently *transforming* both education and society.' (Hall, 2000 p. 3, cited in Harwood and Hadley, 2004, p. 356, original emphases). In this approach, the role of the EAP teacher is to facilitate critical thinking in the form of this kind of critique. My research project does not focus particularly on enabling students to challenge academic norms. However, the University of Sheffield (2020), for example, like many other universities (Howe, 2016), claims to produce graduates who can use their knowledge to "make a difference in the world", which recalls Hall's social transformation. The "criticality" model of critical thinking, too, is concerned with the individual's role in the world. The premise of my study is that EAP teachers need not be confined to teaching language, or even critical thinking as skills or dispositions, but that their remit can include encouraging students to engage with real world issues such as climate change, as I do in my workshops.

The next section explores the models of critical thinking in more depth, how they might be developed in higher education or EAP students, and how they relate to my research project.

2.4 Three models of critical thinking

2.4.1 Critical thinking as "skills-and-judgments"

Critical thinking is required by all disciplines in Western academia. To Facione's "interpretation, analysis, evaluation and inference" (1990, p. 2), other writers add: recognising and examining other people's biases and one's own, and identifying or challenging hidden assumptions (Jones, 2015); evaluating other people's arguments (Cottrell, 2011); resistance to framing (Toplak et al. 2013) and to social pressure to conform (Cottrell, 2011); and acknowledging uncertainty (Jones, 2015) and multiple perspectives (Toplak et al., 2013). The skills which are prioritised or emphasized vary according to discipline, as discussed below.

As mentioned above, the traditional conception of the role of EAP teachers in the West is to prepare students for, or support them in, their study within their chosen discipline. As Dudley-Evans suggests, critical thinking in EAP is often presented as the teaching of skills as opposed to the fostering of dispositions or criticality (Dudley-Evans, in Benesch 2001). Moore (2019) consistently frames critical thinking in this way in a guide for EAP teachers published by Cambridge English, perhaps the best-known English language teaching organisation in the world. Moore claims that "our preferred definition [is] that critical thinking is 'the ability to analyse, synthesise, interpret and evaluate ideas, information, situations, and texts'" (2019), which is consistent with both Facione's (1990) definition and Davies and Barnett's description of the "skills-and-judgments" approach (2015).

In my own study, I encourage EAP students to engage in "thinking about thinking" or "metacognition" (Davies and Barnett, 2015, p.12), but there is some debate about whether this is a skill, a disposition, or both. Metacognition means reflecting on one's own thinking, for example in order to select which critical thinking skills to use for a cognitive task. For some, for example Davies and Barnett (2015), metacognition itself counts as a skill. Others specifically place it outside the skills category, but believe that both skills and metacognition are necessary for critical thinking (Kuhn 1999; Lodge, O'Connor, Shaw and Burton, 2015; Maclellan and Soden, 2011). The place of metacognition will be discussed in more detail later in this chapter.

Developing critical thinking as "skills-and-judgments"

Three approaches to teaching critical thinking skills for academic study have been outlined by Ennis (1989); the "general" approach, where they are taught separately from content; the "infusion" approach, where they are taught alongside subject content; and the "immersion" approach, in which they emerge from content teaching. In the infusion approach, as opposed to the immersion approach, "general principles of critical thinking dispositions and abilities *are made explicit*" (p. 5, original emphasis). My own research could be classified as taking the general or infusion approach, as discussed below.

The general approach

There is some disagreement over the extent to which critical thinking skills are transferable, which would be necessary for the "general" approach to be effective. For "generalists", like Davies (2013, 2006) and Ennis (2015, 1989), there are core critical thinking skills, such identifying premises and recognising fallacies, the development of which is not dependent on context. On the other hand, "specificists" such as Moore (2011) and McPeck (1981) believe that critical thinking is best fostered within the norms and paradigms of an academic discipline, although Moore (2019) later concedes that this approach is not easily implemented in EAP. According to Moore, McPeck goes so far as to contend that any critical thinking skills that could be generalised across the disciplines would be "trivially obvious" (McPeck, 1992, p. 202, cited in Moore, 2011, p. 263), and that "the only truly useful thinking skills tend to be limited to specific domains or narrower areas of application" (Moore, 2011, p. 263). Moore (2011) has indeed found that the disciplines of philosophy, history and literary studies differ in their conceptualisation of judgment making and the focus of their critical analysis.

This view of critical thinking as context-specific is partly due to differences among disciplines in what Jones calls "epistemic culture" (2007, p. 85). Ennis (1989) explains that the "the epistemological version of subject specificity" advocated by McPeck (1981) "holds that in different fields different sorts of things count as good reasons, so critical thinking varies from field to field" (p. 7). For example, mathematics accepts only deductive proof; some social sciences value statistical significance; and subjectivity is acceptable in the arts

(although it should be noted that these elements of critical thinking may also be highly valued in other disciplines).

However, Davies (2006) claims that it is a "fallacy of the false alternative" to insist that critical thinking should be "*either* thought of as a 'generic' skill *or* … a subject-specific category, *but not both*" (p. 180, original emphases). Ennis (1989), while acknowledging that subject knowledge is necessary for critical thinking within disciplines, maintains that there are "interfield commonalities", for example "agreement that conflict of interest counts against the credibility of sources, and agreement on the importance of the distinction between necessary and sufficient conditions" (p. 8). Davies (2013) argues that sophisticated discipline-specific skills are built on the foundations of more basic skills which should be mastered first. To demonstrate, as an example, the somewhat generic nature of argumentation, he rephrases arguments in texts from varying disciplines as syllogisms (a form of reasoning where conclusions are drawn from given or assumed premises). He is careful to point out, however, that such simple techniques do not do full justice to the subtleties of critical thinking within a discipline. "I am suggesting that both approaches – generalist and specifist – are used" (Davies, 2006, p. 187).

Jones (2015) maintains that "while there are common elements of critical thinking, it … occurs within the conventions, methodologies, and knowledge bases of particular disciplines and fields and within the structures that they provide" (p. 169). My brief exploration of these similarities and differences among the somewhat diverse disciplines of history and medicine (Jones, 2015, 2007), nursing (Brudvig, Dirkes, Dutta and Rane, 2013; Douglas, 2012; Drennan, 2010; Gupta and Ushur, 2012; Papp et al., 2014), engineering (Ahern, O'Connor, McRuairc, McNamara, and O'Donnell, 2012; Claris and Riley, 2012; Pierce, Gassman and Huffman, 2013), and business studies (Coleman, Mason and Steagall, 2012; Reid and Anderson, 2012; Switzer and Barclay, 2012) suggest that while different academic disciplines emphasise different critical thinking skills, there is a degree of overlap. Some skills appear to be discipline specific to a greater or lesser degree. For instance, amongst these studies, the evaluation of models features only in engineering (in Jones' 2007 study it also features in economics). Problem solving appears to be particularly valued in engineering, creative thinking in engineering and business studies, and acknowledgement of multiple perspectives in history. However, these also feature in the critical skills sets of

other disciplines, and many skills appear to be common to all of them, e.g. identifying or challenging hidden assumptions, evaluating or building arguments, having a strong evidence base, recognising or examining bias, and reflexivity on one's discipline or one's own work.

Moore (2019) claims that the generalist view prevails in EAP because teachers often have students from many different disciplines in their classes. Although Moore suggests that a subject-specific approach would be preferable, the evidence that many critical thinking skills are common to a range of disciplines suggests that EAP teachers can indeed teach critical thinking effectively without confining themselves to one particular disciplinary context, as in my own research project. Nevertheless, it is worth examining the effectiveness of models other than the generalist approach for teaching critical thinking skills, both in departments and in EAP classes.

The infusion and immersion approaches

As seen above, the general approach assumes that critical thinking skills can be learnt independently of academic context. Nevertheless, instruction on critical thinking skills *per se* is unlikely to occur in degree courses, where academics focus on content, or in EAP syllabi, where teachers are supposed to focus on language.

Students in higher education are often expected to pick up critical thinking naturally along with content, as in the immersion approach, for example in economics and history (Jones, 2007) and engineering (Ahern et al., 2012). However, there are some doubts over the extent to which these students can demonstrate critical thinking skills in the early years of study. Similarly, Drennan (2010) reports that the immersion approach to teaching critical thinking to nursing students has had disappointing results, and that an infusion approach might be more successful. Welch, Heib and Graham (2015, p. 113) advise starting with "explicit and implicit instruction" in critical thinking for engineering students, moving into immersion only later in the course. An infusion approach is also favoured in nursing (Drennan, 2010), medicine (Jones, 2015) and business studies (Reid and Anderson, 2012; Switzer and Barclay, 2012).

As seen above, Moore believes that EAP must necessarily follow a generalist approach as it is impractical to teach critical thinking skills within the norms and paradigms of one discipline. However, as language skills are the "subject content" of EAP courses and critical thinking skills are taught to enable such language-based activities as essay-writing and seminar participation, this might also be classed as an infusion approach. There is evidence of English language teachers making the principles of critical thinking explicit, as required by this approach. For example, Tanaka and Gilliland (2016) expect their students to demonstrate in their writing tasks three critical thinking principles they have been given. Pally (1997, p. 293) believes that critical thinking in ESL is best taught through a "sustained content" approach, through prolonged focus on one subject area and the explicit teaching of critical thinking principles. Students on a sustained content EAP course for engineering "appear to recognise the critical/analytical appraisal approach emphasised in the EAP course while also interpreting its relevance and significance as intrinsic to engineering" (Melles, 2009, p. 138), suggesting that critical thinking skills are transferable. An infusion approach in EAP is also advocated by Wilson (2016), Boivin and Razali (2013), Maclellan and Soden (2011) and Arnó-Macià and Rueda-Ramos (2011). In addition, Maclellan and Soden (2011) argue that metacognition, which is necessary for reflection and therefore for critical thinking, "is not an automatic consequence of formal educational experiences" (p. 3), suggesting that an infusion rather than an immersion approach might be most appropriate for both subject and EAP courses.

The infusion approach, with its explicit focus on elements of critical thinking, appears to be more effective across the board than the immersion approach, where students are expected to acquire critical thinking skills or dispositions automatically while studying within their disciplines. There is also evidence, as discussed above, that elements of critical thinking may be cross-disciplinary. This suggests that it would be worthwhile for an EAP teacher to explore factors affecting critical thinking with a group of students of mixed academic backgrounds, as in my own study. The approach I took, which is described in more detail in the Methodology chapter, could be classed either as a generalist approach, as the main focus was critical thinking, or as an infusion approach, as all the participants were studying English for Academic Purposes and so arguably were developing critical thinking alongside

their language skills. However they are categorised, the critical thinking principles underpinning my workshops were made explicit to the participants.

The next section will survey some techniques used by both EAP teachers and academics to foster critical thinking skills using the infusion approach.

Techniques for teaching critical thinking skills

The studies on the different disciplines above suggest that various techniques are used by academics to foster critical thinking skills in students, many of which are also used in EAP. These include: questioning or other techniques to highlight aspects of critical thinking; discussion or debate; collaborative, cooperative or participatory learning; problem-solving; and case studies. I used all these techniques, which are discussed below, on my own critical thinking course (see the sections on designing and running the workshops in the Methodology chapter).

Jones (2007) shows that even in disciplines such as history and economics, where it is thought that critical thinking "sort of wears off on students" (p. 97), specific techniques are used to develop critical skills, especially in explicitly directing the students' attention to assumptions, flaws in arguments, evidence, bias (including the students' own), and multiple perspectives. Similar techniques for the same ends are also reported in EAP by Thompson (2002); for example Wilson (2016) describes the use of written and oral questions to guide EAP students' efforts to identify arguments in texts, construct meanings and compare and contrast advantages and disadvantages.

The strong tradition of discussion and debate for the development of critical thinking skills is perhaps too obvious to be highlighted in much of the discipline-related literature. It is however an essential feature of collaborative, cooperative or participatory learning, which is advocated for nursing (Drennan, 2010) and engineering (Ahern et al., 2012), and doubtless for other disciplines too. Discussion, debate and participatory learning are also popular techniques in EAP for encouraging multiple perspectives (Codita, 2016; Tanaka and Gilliland, 2016; Thompson, 2002), evaluating and building arguments (Codita, 2016; Maclellan and Soden, 2011; Wilson, 2016), and identifying or challenging hidden assumptions (Pally, 1997;

Thompson, 2002; Wilson, 2016). Kiely (2004) advocates "democracy in the classroom" and "a dialogic, problem-solving approach in the classroom in order to promote critical learning" (p. 213).

Problem-solving is considered to be an important critical thinking skill in (amongst other disciplines) business studies (Coleman et al., 2012; Reid and Anderson, 2012; Switzer and Barclay, 2012), medicine (Jones, 2015), nursing (Drennan, 2010) and engineering (Ahern et al., 2012; Pierce et al., 2013). It is included by Melles (2009) in an ESL course for engineers, but also in more general EAP courses by Boivin and Razali (2013), Kiely (2004), and Maclellan and Soden (2011). Case studies are used to develop problem solving skills in business studies (Reid and Anderson, 2012), medicine (Jones, 2015) and engineering (Pierce et al., 2013). They are also used in EAP for this purpose by Codita (2016), Arnó-Macià and Rueda-Ramos (2011), Maclellan and Soden (2011), and Kiely (2004), but also to highlight the importance of context, evidence and ethics.

In the Methodology chapter, I explain how the constructive approach I took to the workshops was reflected in collaborative learning activities such as group work and discussion, experiential learning activities such as case studies, and learner-centred activities such as problem-solving.

2.4.2 Critical thinking as "skills-plus-dispositions"

Davies and Barnett's second model of critical thinking is "skills-plus-dispositions". They claim that disposition is sometimes defined as a "frame of mind", or "a sense of *psychological readiness*" [original emphasis] to engage in critical thinking, which they describe as disposition in the "weak" sense (Davies and Barnett, 2015; p. 13). They also claim that the relationship between skills and disposition in this sense is "subject to much discussion" (2015, p. 14) but cite Facione et al.'s argument that they are mutually reinforcing; "the disposition toward critical thinking reinforces critical thinking skills and that success with critical thinking skills reinforces the disposition" (Facione, Sanchez, Facione and Gainen, 1995, p. 17).

Davies and Barnett (2015) suggest that disposition in the "strong sense" might refer to more deep-seated personal characteristics which motivate a person to use critical thinking skills, for example the "inquisitive" and "open-minded" qualities of Facione's frequently cited definition of 1990 above. These are reminiscent of the "graduate attributes" that many universities claim for their alumni (Howe, 2016). For example, as well as critical thinking skills such as "lateral thinking in problem solving" and awareness of "a range of perspectives", graduates from the University of Sheffield are expected to be "reflective, self-aware" and "able to exhibit ethical behaviour" (University of Sheffield, 2020), attributes which suggest character traits rather than skills. Davies and Barnett (2015) point out that the marketisation of higher education has driven the promotion of "skills sets" (p. 4) which are supposed to make their graduates more attractive to prospective employers. However, the inclusion in lists of graduate attributes of dispositions, in the sense of character traits, is consistent with the Humboldtian tradition of higher education, whose concept of *Bildung* holds that the purpose of education is to develop to one's mind or character and so achieve one's full human potential (Bleicher, 2006) rather than simply prepare students for employment. Rohstock (2012) points out that the *Bildung* ideal has been upheld by institutions in Europe and the US in opposition to "attempts by governments all over the world to promulgate highly homogeneous reform programmes that defined support for economic growth as the principal aim of national higher education systems" (p. 165). The tension between the neoliberal and Humboldtian views of education will be revisited in the section on critical thinking as "criticality".

Various critical dispositions have been identified in critical thinking literature. Davies and Barnett (2015, p. 13) divide them into three main categories: dispositions in relation to self, those arising in relation to others and those arising in relation to the world (plus a category labelled "other"). However, there is some inconsistency and overlap within and among these three categories. For example, "empathy" and "holding ethical standards" are listed under "self", not "others" as might be expected. "Seeing both sides of an issue" is placed in the "world" category where it might just as logically be put in "others", since only human beings can perceive "sides" to an issue. "Scepticism" and "open-mindedness" might pertain to information as much as people, unlike "respect for alternative viewpoints", which is placed with them in the "others" category.

Therefore, I propose an alternative categorisation of the dispositions identified in critical thinking literature, detailed below. Although there is still some overlap, I would argue that the dispositions can be organised more logically into the following three categories: those oriented to 1. information or ideas 2. the self and 3. other people.

1. Dispositions oriented toward knowledge, information, ideas or content:

- *inquisitiveness* (Davies and Barnett, 2015; Facione, 1990)
- *tolerance of ambiguity* (Davies and Barnett, 2015; Claris and Riley, 2012; Gupta and Ushur, 2012; Reid and Anderson, 2012)

and also possibly

- *resistance to framing* (Toplak et al., 2013)
- *open-mindedness* (Davies and Barnett, 2015; Facione, 1990; Thompson, 2002)
- *awareness of multiple perspectives* (Codita, 2016; Jones, 2007; Tanaka and Gilliland, 2016; Thompson, 2002)
- *scepticism* (Davies and Barnett, 2015)

although these last four might also come under the third category: "Dispositions oriented towards other people".

2. Dispositions oriented toward the self

- *metacognition* (Kuhn 1999; Lodge et al., 2015; Maclellan and Soden, 2011)
- *self-awareness* (Kuhn and Dean, 2004; Papp et al. 2014; Thomas and Lok, 2015; Thompson, 2002)
- *intellectual honesty* (Facione, 1990; Gupta and Ushur, 2012)
- *critical self-reflection* (Papp et al. 2014; Thomas and Lok, 2015)

3. Dispositions oriented towards other people

- *respect for others' views* (Davies and Barnett, 2015; Maclellan and Soden, 2011; Riggs and Hellyer-Riggs, 2014; Tanaka and Gilliland, 2016)
- *otherside thinking* (Toplak et al., 2013)
- *resisting authority or peer pressure* (Claris and Riley, 2012; Fahim and Hajimaghsoodi, 2014)
- *fair-mindedness* (Claris and Riley, 2012; Davies and Barnett, 2015; Facione, 1990)
- *empathy* (Claris and Riley, 2012; Riggs and Hellyer-Riggs, 2014)
- *ethics* (Claris and Riley, 2012; Davies and Barnett, 2015; Jones, 2007; Riggs and Hellyer-Riggs, 2014; Thompson, 2002).

The aim of my workshops was to develop participants' understanding of their own and other people's thinking processes, and of how these are affected by common human characteristics, as discussed later in this chapter. If successful, one might expect to see a shift in participants' critical dispositions towards the second and third types above. (See the Discussion chapter, pp. 152-153).

The first group of dispositions, those oriented to information and ideas, are perhaps most closely related to critical thinking "skills" as Ennis, Davies and Barnett and others would describe them: that is, questioning, analysing, problem solving and so on. "Metacognition" could be defined as a skill; as one of the "dispositions oriented toward the self" in the categorisation system above; or even "dispositions oriented towards other people", if understanding oneself helps one to understand human nature better and so to empathise more deeply with other people. In fact, concepts of metacognition cover a spectrum, one end of which is more closely allied with skills, and the other with disposition or criticality. At one end of this spectrum, metacognition is "strategic", and means simply knowing what critical thinking skills should be applied to a cognitive task to achieve one's goals (Efklides, 2008; Kuhn, 1999; Sadeghi et al., 2014). At the other end of the spectrum are *metacognitive* knowing and *epistemological* knowing:

> Metacognitive knowing operates on one's base of declarative knowledge, which also stands to benefit from executive management. What do I know, and how do I know it? Finally, epistemological knowing has to do with an individual's broader understanding of knowledge and knowing. It has both a general, philosophical aspect – How does anyone know? – and a personal aspect – What do I know about my own knowing? (Kuhn, 1999, p. 18).

It could be said that these two types of metacognition require a person to understand their own mind and acknowledge their own biases, as well as understanding how other people come to have different perceptions of reality to their own.

There is some debate over whether metacognition can be taught, a question that will be explored later in this chapter. However, Lodge et al. (2015) argue that practising critical thinking skills helps: "deliberate practice requires that students are aware that the activity is aimed at improving their skills, hence triggering reflective metacognitive processes" (p. 402).

Developing critical thinking as "skills-and-dispositions"

As with metacognition, there is also some debate over whether dispositions can be taught, given that they can be viewed as personal traits (Barnett, 2015; Cottrell, 2011; Wilson, 2019). My workshops, if successful, should develop critical dispositions relating to understanding the self and others, so my study rests on the premise that these are indeed teachable.

Cottrell (2011, p. 2) claims that "critical thinking is not about natural traits or personality; it is about a certain set of methods aimed at exploring evidence in a particular way", but suggests that personal characteristics such as scepticism can be overcome by applying "structured approaches" to cognitive tasks. Cottrell does mention Ennis's "dispositions" (Ennis, 1987), but describes them in terms of skills, for example the ability "to reflect sceptically" or "to think in a reasoned way" (p. 2), which also suggests that they can be taught. Wilson (2019) expressly refutes the idea that "[i]f critical thinking is a matter of dispositions, it could be argued that critical thinking is a personal quality that cannot be taught – perhaps critical thinkers are born, not made". She cites Bloom's taxonomy and Harwood and Hadley's "'critical pragmatism'" as example frameworks through which a

critical disposition can be fostered (Bloom et al., 1956; Harwood and Hadley, 2004; both cited in Wilson, 2019, p. 8).

Facione et al. (1995) suggest that skills and dispositions are mutually reinforcing. So one possible method of fostering critical thinking dispositions is through related critical thinking skills. For example, it would be reasonable to expect Davies and Barnett's dispositions of "fair-mindedness" and "scepticism" (2015, p. 13) to be developed by exercising the respective skills of "evaluating arguments" and "analysing claims" (p.12). Barnett (2015, p. 73) argues that "the development of disposition [is] ... ultimately, a responsibility of the student", and that the role of the educator is to facilitate this by providing a suitable educational environment. Educators might do this by encouraging students to reflect on their own cognitive processes as they practise these skills, as in my workshops.

Various methods are employed in both academia and in EAP to develop critical dispositions. Techniques to foster reflective or reflexive practice such as writing a journal or using self or peer assessment are used in disciplines such as medicine (Jones, 2015), nursing (Drennan, 2010) and engineering (Claris and Riley, 2012). EAP teachers also use journals or diaries (Kiely 2004; Wilson, 2016); reflective writing (Boivin and Razali, 2013); peer critique (Maclellan and Soden, 2011); and self-critique (Tanaka and Gilliland, 2016; Thompson, 2002) to develop critical dispositions. However, reflective writing such as keeping a journal is time-consuming and is typically done outside the class (Wilson, 2016), and peer and self-critique can require learner training, so for my short course of workshops I mostly used techniques that can be done in class with little or no preparation, such as discussion and questioning (see the Methodology chapter, p. 62).

Discussion is used to develop reflection and reflexivity in disciplines such as business studies (Switzer and Barclay, 2012) and nursing (Drennan, 2010), and in EAP (Arnó-Macià and Rueda-Ramos, 2011; Kiely, 2004; Tanaka and Gilliland, 2016). Tanaka and Gilliland (2016) advocate a "dialectical approach" using reading and writing on complex issues to develop dispositions such as awareness of one's own biases, open-mindedness and respect for others' views. Lodge et al. (2015) cite Halpern's claim that "'well-structured questions'" can be used to develop metacognition and reflection on learning in higher education (Halpern, 1998, p. 454, cited in Lodge et al., 2015). In EAP, Wilson reports the use of spoken and written questions to develop reflexivity in reading. The use of questions for critical

consciousness-raising in EAP is also reported by Arnó-Macià and Rueda-Ramos (2011), Kiely (2004), Maclellan and Soden (2011), Pally (1997), Tanaka and Gilliland (2016), and Thompson (2002).

2.4.3 Critical thinking as "criticality"

Davies and Barnett's third model of critical thinking is "criticality" or "skills-plus-dispositions-plus-actions" (2015). Just as there is overlap between the models of critical thinking as skills and as dispositions, for example in the various concepts of metacognition, so dispositions relating to ethics or "moral agency" (Riggs and Hellyer-Riggs, 2014, p. 3) are integral to this model of criticality. As Davies and Barnett (2015) point out,

> This is a sense of "critical thinking" that extends beyond the individual and his or her cognitive states and dispositions to the individual's participation in society as a critically engaged citizen of the world. Note that it also includes a *moral* and *ethical* dimension to critical thinking. After all, critical thinkers do more than reason; they also *act ethically* on the basis of their reasoned judgments (p. 16, original emphases).

As well as "ethics", other dispositions that might be particularly relevant to criticality are "respect for others' views" and "empathy", all from the "oriented towards other people" category.

Developing critical thinking as "criticality"

In the section on critical thinking as dispositions above, I mentioned the tension between the Humboldtian tradition of education as the development of the character, and the modern trend towards viewing education as existing principally to serve the economy. This trend is seen by some writers as a threat to the place of criticality in higher education. Morrall and Goodman (2012) fear that the growth of neoliberalism in higher education has resulted in a narrow vocational focus at the expense of "genuine academic freedom to think, and genuine studentship to learn to think" (p. 935), and argue that recognising power structures, challenging the status quo and ethics should be included in critical thinking for nursing. Claris and Riley (2012) call for engineering to go beyond problem solving and logical thinking skills to thinking critically about "problem framing, power relations within

the profession, hegemonic epistemologies of the discipline, [and]… reproductive practices of engineering education" (p.102). They argue:

> When CT [critical thinking] is not limited to the logical ability to identify a faulty argument, but includes the reflective and reflexive practice of being ethically and socially responsive, CT becomes not just a way of thinking but also a way of being (p. 103).

Attempts are also made in history and economics (Jones, 2007) to develop this kind of criticality in students by highlighting power structures, social context and ethics, as well as the values and traditions of the discipline.

The "criticality" approach is sometimes also taken in EAP, although there is some debate over how this should be realised in practice (Allison, 1998). Pennycook argues that critical EAP cannot be reduced to "teaching techniques, methods or approaches as they are commonly understood within TESOL" (1999, p. 341), but suggests that teachers should seek opportunities in the classroom to do their critical teaching (Pennycook, 1994, cited in Benesch, 2001), a concept that Morgan calls "emergence" (2009, p. 87). In contrast to Pennycook's claim that there are no underlying rules for critical EAP, Crookes and Lehner (1998) propose a set of principles for critical EFL/ESL, including dialogue, the redistribution of power in the classroom, the use of topics that are relevant to the learners, and the problematisation of their own situations. The first two of these four principles are exemplified by Kiely's "dialogic, problem-solving approach … to promote critical learning" and "democracy in the classroom" (2004, p. 213), while the last two are demonstrated by Thompson's problematizing of the treatment of indigenous Australians in EAP texts to highlight power structures, social context and ethics (2002). In my own workshops, I drew on these principles by using collaborative and experiential learning (see the Methodology chapter, pp. 62-63), and attempting to both reduce the power balance between teacher and students and to relate the topics to the students' own lives.

Benesch (2001) argues that EAP teachers should choose topics that are not only relevant to students' daily lives, but also stimulate discussion of wider social issues. Allison (1994) points out that "[a]n EAP classroom is part of an educational and social world, and it can offer a significant point of departure for learner's own explorations and experiences of other issues" (p. 622). One topic that is universally relevant and worthy of the attention of

Davies and Barnett's "critically engaged citizen in the world" is climate change, as discussed in the next section.

2.5 Critical thinking and human nature

Critical thinking does not come naturally to human beings, which is why it has to be taught (Kuhn and Dean, 2004; van Gelder, 2005). Van Gelder claims that "critical thinking is hard … and most people are just not very good at it … [the] majority of people cannot, when prompted, reliably exhibit basic skills of reasoning and argumentation" (2005, p. 42). The role of EAP teacher includes preparing students for their future studies by helping them to become better critical thinkers (Allison, 1996; Benesch, 2001; Cadman, 2002; Moore, 2019). It is important to note however that critical thinking is challenging not only for the international students who make up the vast majority of EAP classes, but for everyone. It is also worth noting that if disposition in Davies and Barnett's "strong sense" (2015) can be equated to character or personality, then individuals differ from each other in terms of the critical qualities they already have and those they have still to develop (Cottrell, 2011). Nevertheless, there are certain psychological and sociological factors that are thought to affect all human thinking, including critical thinking, and understanding these may clarify why it is often difficult.

2.5.1 Psychological and sociological factors that affect critical thinking

"Critical thinking" is a term traditionally employed by educationalists. However, the work of cognitive psychologists can help to illuminate the processes involved in critical thinking, and the reasons why it sometimes fails, for example when biases occur. West et al. (2008) claim that "[m]any theorists view critical thinking as a subspecies of rational thinking or at least as closely related to rational thinking", adding that the cognitive biases studied within cognitive psychology can be "legitimately thought of as aspects of critical thinking" (p. 930). It has been argued, for example by Gee (2005) and Street (2005), that the concept of rationality carries ethnocentric assumptions, as different cultures employ different styles of reasoning. However, as discussed below in the section on critical thinking in non-Western

cultures, features of "Western" style rational thinking, such as the use of evidence in argumentation, verbal reasoning, and inference making, are present in other scholastic traditions.

Covering all the known cognitive biases that might affect critical thinking (see Appendix 1 for a complete codex of these) is outside the scope of this thesis. In this study, I have focused on the factors that influence attitudes to climate change and have impeded action (American Psychological Association [APA], 2011; Marshall, 2014; Norgaard, 2009; Pigeon 2012). Climate change is arguably the greatest challenge humanity has ever faced, (UN, 2020). Despite several international treaties, such as the Paris Agreement of 2015, and improvements in "green" technologies, temperature rises worldwide are on track to reach four degrees Celsius, in the face of the scientific consensus that a rise of more than 2 degrees could be catastrophic (IPCC, 2014a; Le Page, 2017; UNFCCC, 2015). The failure to deal with this challenge effectively is partly due to the low priority that has historically been given to the issue by individuals and society (APA, 2011; Marshall, 2014; Norgaard, 2009; Pigeon, 2012), notwithstanding the recent increase in interest in the issue and salience in public discourse, as evidenced in the rise of such campaigning groups as Extinction Rebellion (British Broadcasting Corporation [BBC], 2019a). Attitudes to climate change commonly include denial, apathy, trivialisation, cognitive dissonance, and other reactions which appear illogical in the face of the evidence about the seriousness, urgency and scale of the problem (Marshall, 2014).

The cognitive and affective barriers that psychologists argue prevent people from taking climate change seriously, including various types of bias, are similar to barriers to critical thinking described in some educationalist literature (Stanovich and West, 2008; Toplak et al., 2013; West et al., 2008), a relationship which will be explored later in this chapter. In addition, climate change is a popular topic for EAP because it is a global problem and is relevant to several academic disciplines, as discussed below. Students who are at university now are part of the generation that will have to tackle this problem, whether it features in their degree courses or not. Raising awareness of climate change in a critical thinking course therefore seems fitting from a criticality point of view. These are the reasons I chose to focus on factors relating to climate change.

From the field of psychology, Dual Process Theory furnishes a useful theoretical basis for the analysis of critical thinking, whether regarded as skills or dispositions, and of its associated pitfalls. Dual Process Theory postulates two modes of human thinking, known as "intuitive" and "reflective" (Evans, 2010), or less descriptively as "System 1" and "System 2" (Kahneman, 2011), or "Type 1" and "Type 2" (Toplak et al., 2013).

System 1 thinking is thought to have evolved first, is quick, effortless and involuntary, and is essential for normal functioning, but it can lead to faulty reasoning (Kahneman, 2011) or other critical thinking flaws, as discussed below. Decisions are routinely made initially by the intuitive mind, although they may be overturned or rationalised by the reflective mind. Emotions play an important role in System 1 thinking (Evans, 2010).

System 2 thinking is believed to be unique to, or at least most developed in, human beings. It is associated with logical reasoning, mentally retaining more than one hypothesis simultaneously, and following rules. Research suggests that early training in the self-control required for this kind of thinking leads to a more effective use of System 2 (Evans, 2010; Kahneman, 2011). However, such self-control is cognitively, emotionally and physically taxing; Kahneman says that System 2 is "lazy" (2011, p. 44), which leads to shortcuts in reasoning and so to poor judgements and bias. Motivation to make the effort to use System 2 thinking may depend on personality (Kahneman, 2011) and on the awareness of the need to apply critical thinking strategies (Toplak et al., 2013). System 2 is also involved with choice, the agency associated with Facione's "self-regulatory judgment", and decision-making (1990). In fact, Toplak et al. (2013) argue that "an important function of [System 2] processes is to take early representations triggered by [System 1] processing offline and to substitute better responses" (p. 1,045), which suggests the processes of critical thinking at work.

The field of sociology also provides insights into critical thinking skills and dispositions. Critical thinking is often equated with independent thinking, as suggested by Facione's description of critical thinking as "self-regulatory judgement" (1990, p. 2). However, humans are a social species in which individuals depend on the protection of the group for survival (Marshall, 2014). Thus, the instinct to assimilate with the values and behavioural norms of one's peers or in-group (Rabinovich et al., 2011), and by extension one's society or culture (Norgaard, 2009), is very strong. These values can be internalised so that they form part of

the “frames” through which we view the world (Goffman, 1974, cited in Marshall, 2014, p. 80). Critical thinkers need courage to resist this natural inclination to conform.

These perspectives from cognitive psychology and sociology may throw light on common barriers to critical thinking, whether viewed as skills or dispositions. The tendency of System 1 to accept new information before System 2 can judge its reliability leads to “bias to believe” (Kahneman, 2011, p. 80). Although challenges to one’s belief systems can be painful (Cottrell, 2011), avoiding belief bias is essential to rational thinking and is associated with critical dispositions (Toplak et al., 2013; West et al. 2008), arguably scepticism (Davies and Barnett, 2015) and critical self-reflection (Papp et al. 2014; Thomas and Lok, 2015). Belief bias in turn exacerbates “myside bias”, or “confirmation bias”, that is, the rejection of information that does not fit existing beliefs (Kahneman, 2011; Toplak et al., 2013; West et al. 2008). Confirmation bias impacts the collection and evaluation of evidence and hypothesis testing, to the detriment of Facione’s skills of “interpretation, analysis, evaluation and inference” (1990, p. 2). It also affects the skill of seeing other perspectives (Evans, 2010; Jones, 2015), with implications for the disposition of open-mindedness (Davies and Barnett, 2015; Facione, 1990; Thompson, 2002).

Belief bias and confirmation bias help to form the “frames” through which we interpret information, and which are “constructed of our values, our life experience, and the social cues of the people around us” (Marshall, 2014, p. 80). Frames are thought to exist in children as young as five (Toplak et al., 2013), and Lakoff (2010) claims that they are embedded in our neural circuitry. However, resistance to framing is necessary for rational (or critical) thinking (Toplak et al., 2013), and an awareness of how arguments may be framed may aid the skill of identifying or challenging hidden assumptions (Jones, 2015).

Biases also arise from our tendency to favour the beliefs of those we love and trust (Kahneman, 2011) and to be influenced by social or cultural pressure to conform (Cottrell, 2011; Evans, 2010; Norgaard, 2009). Urging higher education students to resist this pressure, Cottrell (2011) points out that “the result of your critical thinking might place you in a minority amongst your friends, family and colleagues” and that “it takes courage to argue an alternative point of view” (p. 6). Peer pressure and cultural conformity result in selective attention and interpretation (Norgaard, 2009), and socially organised silence (Zerubavel, 2006), where there is an unspoken agreement to ignore painful truths.

Norgaard argues that because knowledge is "socially structured", a kind of conscious "not-knowing" (2009, p. 22) is sometimes necessary in order to follow cultural norms, to avoid painful emotions and to feel comfortable in one's (socially constructed) identity. This has clear implications for the dispositions of intellectual honesty (Facione, 1990; Gupta and Ushur, 2012) and resisting authority or peer pressure (Claris and Riley, 2012; Fahim and Hajimaghsoodi, 2014). Facione's "self-regulatory" or independent thinking (1990) and the skill of recognising and examining other people's biases and one's own (Jones, 2015) also depends on the ability to resist framing and social pressure.

Human beings have a strong narrative instinct, and stories are central to our understanding of the world. Humans are

> pattern-seeking, story-telling animals. We like things to make sense, and the kinds of sense we grasp most easily are simple, familiar patterns or narratives … [this is] a make-sense epistemology (van Gelder, 2005, p.42).

This results in a tendency to see cause-and-effect patterns where they may not exist, and to bridge gaps in our knowledge with our own suppositions to create a plausible tale (Kahneman, 2011; van Gelder, 2005). This is detrimental to critical thinking skills such as identifying or challenging hidden assumptions, evaluating or building arguments, using evidence, and acknowledging uncertainty, as identified by Jones (2015). Pattern-seeking behaviour leads people to underestimate the part that chance plays in events, thus undermining their ability to assess risk and so to make rational decisions. It also leads to "hindsight bias", or the unsubstantiated belief that one was able to predict a past event, and "outcome bias", or judging the quality of a decision only by its consequences. These two biases partially account for the poor skills in assessing probability as well as risk common in human beings (APA, 2011; Kahneman, 2011), and threaten to interfere with Facione's "judgement which results in interpretation and analysis … and explanations of the conceptual and methodological … considerations on which that judgement is based" (1990, p. 2). Hindsight bias and outcome bias obscure other interpretations, such as luck playing a major role in how events play out, thus impacting on the likelihood that multiple perspectives will be considered (Jones, 2015). Interestingly, System 2 reasoning, though faulty, is behind both these biases (Kahneman, 2011). Risk perception is also influenced by the intuitive tendency to give greater weight to losses than to gains, and by optimism

(Kahneman, 2011). In general, it is "influenced by associative and affect-driven processes as much or more than by analytic processes" (APA, 2011, p. 23). Consciousness of these cognitive biases should contribute to the disposition of self-awareness.

As detailed in the Methodology chapter, in my workshops I chose to explore five areas or factors that impact critical thinking outlined above: belief bias; confirmation bias; framing; the influence of cultural or social pressure; and the assessment of probability and risk.

2.5.2 Critical thinking in non-Western cultures

There is some debate about whether the concept of "critical thinking" is culturally biased towards the West and so particularly difficult to acquire for students from other regions of the world such Asia (where most of my participants are from) (Atkinson, 1997; Norris, 1995), or whether this is an outworn and unfair stereotype (Paton, 2005; Stapleton, 2002).

Ryan and Louie (2013) criticise as simplistic discourses around internationalisation which present the educational philosophies of East and West as dichotomous, informed "by widely differing historical and cultural perspectives, from western to Confucian, from liberal to communitarian, from colonial to postcolonial communitarian" (p. 405). They add that students from Asian countries, particularly those with a Confucian tradition, are often unfairly characterised as "passive, dependent, surface/rote learners prone to plagiarism and lacking critical thinking" (p. 406). However, they point out that it is difficult to make generalisations about pedagogic practice and ethos across different institutions within one country, such as the UK, much more so to justify stereotypes of educational cultures in different hemispheres. In fact, scholarly thinking in traditionally "Eastern" philosophies share some features with "Western" critical thinking practices. Evaluating arguments, building arguments by supporting one's claims with examples and evidence, verbal reasoning and inference making are all valued in Buddhist thinking (Lugli, 2015). There is a tradition of syllogistic argument in the philosophies of both Buddhism (Lugli, 2015) and Hinduism (Vaidya, 2017) which is similar to the syllogisms of informal logic in the West. Even "Socratic" questioning, as a means of guiding students to their own discoveries and developing their thinking and reasoning skills, is also used in Buddhist and Confucian

scholarship (Ryan and Louie, 2013). Critical thinking is also arguably compatible with the Islamic scholastic traditions (Bali, 2015), as discussed below.

The debate over whether students from non-Western countries are disadvantaged by their educational background when learning to think critically is acknowledged by Manalo et al. (2015) in their comparison of Japanese and New Zealand students; Dong (2015), and Tian and Low (2011), who focus on China; and Bali (2015), who discusses critical thinking in Egypt and the Arab world. All cite studies that suggest that perceived differences between Eastern and Western students' critical thinking performance are largely due to differences in English language proficiency and their own educational experiences rather than their national culture. Bali (2015) and Tian and Low (2011) warn against stereotyping students from a particular country or region, and stress the importance of treating students as individuals.

Dong (2015) concedes that due to its tradition of logic training, critical thinking tuition in China has been restricted to "the logical analysis of single arguments" with little opportunity for discussion, questioning or the development of independent learning or critical dispositions (p. 356). However, Dong critiques the stereotype of passive Chinese students abroad who find critical thinking difficult due to their Confucian and collectivist culture (which in any case has changed radically in recent years), and cites several studies showing that Chinese and other Asian students can and do exhibit sophisticated critical thinking skills, especially when language barriers are lowered. Tian and Low (2011) add that lack of familiarity with Western discourse norms or the context of their discipline can also affect how tutors and supervisors evaluate the critical thinking performance of Chinese international students.

In their comparative study, Manalo et al. (2015) found "no evidence of an East-West difference in knowledge and awareness about useful thinking skills" (p. 312), but did find many points in common, including understanding other people's points of view (on which the Asian students placed particular emphasis), independent thinking, and metacognition. Japanese students also valued rationality, looking at an issue from different angles, being able to challenge ideas, avoiding bias, and being reflective.

Bali (2015) claims that "the ideas and practices of CT [critical thinking] exist even in my own Egyptian Islamic culture". She points out that the Islamic tradition of *ijtihad* overlaps with the Western notion of critical thinking, especially in critical reflection, questioning and evaluating the credibility of sources. Like Buddhist scholarship (Lugli, 2015), *ijtihad* also allows for multiple interpretations of texts, although it differs from the Buddhist tradition in excluding religious texts considered to be authoritative, such as the Koran or the Hadith (Encyclopaedia Britannica, 2018). Bali claims that although repressive political regimes and traditional curricula can repress this critical spirit, it lives on in Egypt in informal settings (as shown by the uprising of 2012 - 2013).

Like the insights from psychology and sociology discussed above, these examples suggest that critical thinking is a universal concept and that students from all backgrounds, such as my participants, might benefit from guidance or help on their critical thinking journey.

2.5.3 Critical thinking barriers to action on climate change

As mentioned above, climate change is an urgent, serious and global problem which humanity has so far failed to tackle effectively. Political and ideological factors which influence the portrayal of the issue in the media are at play here (Marshall, 2014), but these are beyond the scope of this thesis. The failure to tackle the problem is at least in part because of psychological factors which hinder full acknowledgment of the gravity of the problem, personally and in public discourse (APA, 2011; Kahneman, cited in Marshall, 2014; Marshall, 2014; Norgaard, 2009), which in turn hampers effective action (Pigeon, 2012). These obstacles are explored by cognitive psychologists (Evans, 2010; Kahneman, 2011) and sociologists (Norgaard, 2009; Zerubavel, 2006), and reflect barriers to critical thinking often described by educationalists (Stanovich and West, 2008; Toplak et al., 2013; van Gelder, 2005; West et al., 2008).

The barriers to action on climate change include a perceived lack of salience. For many, if not most people, climate change does not seem particularly urgent or relevant to their lives. Kahneman argues that, psychologically, "the greatest salience belongs to threats that are concrete, immediate and indisputable", such as an imminent car crash, whereas climate change is "abstract, distant, invisible and disputed" (Kahneman, interviewed in Marshall,

2014, pp. 56-57). Many people see climate change risks as geographically remote or far in the future (APA, 2011). Even if they experience unusual weather events attributable to climate change, they may not make the connection unless they are already convinced that global warming exists (Howe and Leiserowitz, 2003; Zanocco et al., 2018). The sense of distance is aggravated by the "bystander effect" (Kahneman, 2011, p171) whereby people do not feel at risk in a situation that otherwise appears to be threatening because those around them seem to be unconcerned; Marshall (2014) suggests that socially constructed silence around climate change (Norgaard, 2009) creates this effect. In addition, climate change mitigation requires accepting real and certain costs now, for example in accepting lower living standards, in order to enjoy more abstract, less certain benefits later, which is an unattractive trade-off for many. The reluctance to make such sacrifices is compounded by future discounting, prompted by System 1 thinking, whereby gains or losses seem less significant the further in the future they are (Kahneman, interviewed in Marshall, 2014; APA, 2011). Yet the scientific consensus is that climate change is a global emergency, and one that threatens the lives, livelihoods and lifestyles of people in both developing and developed countries (IPCC, 2014b). The low priority given to the issue represents a clear failure to make judgments according to the evidence as required by Facione's definition of good critical thinking (1990).

There is also perceived uncertainty about whether anthropogenic climate change is even happening, despite extensive evidence. Pigeon (2012) notes that although the scientific community agrees about the root causes of climate change and its broad impacts, the public are often confused by their uncertainty over how exactly these impacts will play out over time. This process, which Pigeon calls "uncertainty transfer" (p. 953), exposes faulty reasoning and an inaccurate interpretation of evidence, in other words, failures in critical thinking (Facione, 1990) This apparent lack of certainty about the existence of climate change reduces the perception of threat (Kahneman, interviewed in Marshall, 2014). Our assessment of risk is influenced more by emotion (APA, 2011) than the processing of data such as statistics, which is cognitively onerous (Kahneman, 2011). This affects our response to climate change, with "analytic consideration suggesting to most people that global warming is a serious concern, but the affective system failing to send an early warning signal" (APA, 2011, p. 23). Our response to climate change is further compromised by our

natural tendency to be more optimistic about future events or the outcomes than the evidence would seem to warrant (Kahneman, 2011).

The emotions of fear, despair, guilt and denial (Norgaard, 2006 and 2009) also hinder acknowledgement of, and action on, climate change. Fear of a threat such as climate change can lead to "the exact opposite of the desired response: denial, paralysis, apathy" (APA, 2011, p. 43). Krosnick, Holbrook, Lowe, and Visser (2006) suggest that the more insurmountable a problem appears to be, the less importance it is given as a social or political issue by the public. Norgaard notes that feelings of hopelessness can be mitigated by individuals through "selective attention, such as controlling one's exposure to information"; however, she claims that essentially "[d]enial is socially organised because societies develop and reinforce a whole repertoire of techniques or 'tools' for ignoring disturbing problems" (2009, p. 27), such as socially constructed silence, or what Zerubavel (2006) calls "the elephant in the room" (p.11). Norgaard has found these tools at work amongst Norwegians whose national identity as simple people close to nature is threatened by the knowledge that Norway derives most of its wealth from oil. The resulting cognitive dissonance is one way of avoiding the guilt associated with the feeling that one should take some personal responsibility for climate change (Norgaard, 2006). Inhabitants of developed countries who express concern about climate change may choose another way: justifying their relatively high-carbon lifestyles, to themselves and others, by making small changes that are claimed to reduce emissions but actually make little or no difference, such as unplugging phone chargers or reusing plastic bags (Marshall, 2014; Rosenwald, 2010). Marshall (2014) argues, however, that the popularity in the early 2000s of lists of minor lifestyle changes that were supposed to save the planet has been used by governments to shift responsibility for tackling the crisis from policy makers to individual citizens.

Nevertheless, denying or downplaying a serious issue such as climate change despite the evidence suggests a lack of the critical thinking disposition of intellectual honesty (Gupta and Ushur, 2012; Facione, 1990), and doing so in order to conform to social expectations shows a lack of another disposition, the ability to resist peer pressure (Fahim and Hajimaghsoodi, 2014; Claris and Riley, 2012). Conversely, acknowledging the global challenge facing humanity and choosing to act accordingly exemplifies criticality, i.e. being a "critically engaged citizen in the world" (Davies and Barnett, 2015, p. 16).

Climate change is a complex and multifaceted problem, which can be framed in various very different ways according to one's world-view (Marshall, 2014), which is in turn informed by culture (Triandis and Gelfand, 2012), and group affiliation (Rabinovich et al., 2012). For example, climate change has been framed as an environmental threat (Greenpeace, n.d.), an economic problem (Carney, 2015), a public health concern (UK Health Alliance on Climate Change [UKHACC], 2017), an ethical matter (Oxfam, 2020) a religious responsibility (Pope Francis, 2015; UNFCCC, 2015), a technical challenge (London School of Economics and the Grantham Institute, 2018), and a political issue (the Labour Party, 2018). These different framings can lead to confirmation, or myside, bias. An example of this is the perception of climate change by the Tea Party, a right-wing US political group whose world-view is based on the "American Dream" of upward mobility and prosperity, their belief in individual liberty, and their deep distrust of the state. Tea Party members like to challenge accepted wisdom and gather information in order to determine "the truth". As Marshall reports, "[t]he problem is that it is so hard to get the right information – meaning that they have to get it from people who share their values". This partisan selection of information has enabled this group to frame climate change as a fraudulent excuse for "big government" to deprive them of their rights, for scientists to secure funding for their research, and for "extreme environmentalists" to attack the fossil fuels industry (2014, p. 18).

These obstacles to action on climate change are clearly related to barriers to critical thinking. In fact, it could be argued that the global failure to tackle climate change effectively represents a global, collective failure of critical thinking, which makes it a particularly apposite topic for an EAP critical thinking course.

2.5.4 Attitudes to climate change in non-Western countries

As noted above, the relevance to critical thinking of the psychological and sociological factors that inform people's attitudes to climate change suggest that it might be a suitable vehicle for developing critical thinking in EAP students. However, according to the American Psychological Association (2011, p. 19), "much of the relevant psychological research [into attitudes to climate change] has been done in North America, Europe, and Australia", whereas a significant proportion of EAP students are not from these regions. For example,

Chinese students form the largest group of international students at British universities (HESA, 2020), including the University of Sheffield, where I conducted my research. Other non-Western countries whose students study at ELTC include the Republic of China (Taiwan) and Saudi Arabia. So it is worth reviewing the available research into common attitudes to climate change in these countries before selecting it as a critical thinking topic for EAP.

Unfortunately, at the time of writing there appears to be little or no literature in English about the perceptions of climate change in Saudi Arabia (although of course this may be available in other languages). However, there is some research in English into attitudes in China and Taiwan. These studies show some differences and similarities between the People's Republic of China and Taiwan, but also many parallels between these countries and attitudes to climate change in Western countries.

Public awareness and concern about climate change is high in both China (Schwirplies, 2018; Yu, Wang, Zhang, Wang and Wei, 2013) and Taiwan (Chou, 2013; Sun and Han, 2018). As in other countries (Norgaard, 2006), this is particularly so amongst the educated in China (Wu et al., 2018) and Taiwan (Sun and Han, 2018). However, Xue, Marks, Hine, Phillips and Zhao (2018) found that cultural world-view is a better predictor of concern than education in China, as has been reported in the West (Marshall, 2014; Zanocco et al., 2018); they suggest that high levels of education may simply enable Chinese people to better rationalise their existing beliefs (Xue et al., 2018), as Kahan, Jenkins-Smith and Braman (2012) have found with Americans.

Wang's research in China suggested that their participants were optimistic about the likelihood of suffering personally from climate change, for example through extreme weather events (2017), which is consistent with findings in the UK (Taylor, Dessai and de Bruin, 2014). On the other hand, Xue, Hine, Marks, Phillips and Zhao (2016) report that their Chinese respondents ignored or denied climate change when they felt powerless to defend themselves against it, a phenomenon which has also been observed in the West (APA, 2011; Krosnick et al., 2006).

To many people in the US and Europe, climate change seems distant in time and place (APA, 2011). This is consistent with research in China suggesting that personal experience of climate change events increases awareness of risk (Wang, 2017; Wu et al., 2018). In

contrast, Sun and Han (2018) find that Taiwanese people's experience of extreme weather events has no impact on perception of risk on either a personal or planetary scale. They suggest that this might be because the victims may not link these events to climate change unless they are already concerned about it, as in the West (Marshall, 2014; Zanocco et al., 2018).

There are therefore broad similarities between the two Chinese republics and Western countries with regards to the influence of education, cultural world-view, optimism, denial and a sense of urgency and immediacy on their attitudes to climate change.

However, there are differences in the way climate change is presented in public discourse. The state-controlled Chinese media presents "an unambiguous view of climate change risks" with no scepticism (Reporters Without Borders, 2020), unlike in the US or the UK (Wang 2017). Chinese people may also have more trust that their government can deal effectively with the problem than citizens of some Western countries; Schwirplies (2018) found that only half of her American and German respondents thought that climate protection measures such as those financed by governments would be effective, as opposed to 84% of the Chinese respondents. On the other hand, Chinese newspapers are less likely than US papers to attribute responsibility for climate change action to the national government, generally taking the official position that "developed" countries should take the lead in reducing global emissions (Wang 2017). In contrast to the people of mainland China, Taiwanese trust in the authorities is low due to a historical lack of transparency about risk from Government. Only a minority of Taiwanese people think their government is open and transparent about their climate change policies or that it could deal with the consequences of severe climatic events (Chou, 2013). There is also low confidence in scientific experts, especially if government authorised.

2.6 The effectiveness of exploring psychological and sociological factors affecting critical thinking

The psychological and sociological factors affecting thinking that are explored in this chapter are directly relevant to higher education study. Belief bias, confirmation bias and framing may affect critical thinking in all disciplines, even those which might be expected to place a

particularly high value on rational and logical thought processes such as the sciences and medicine (Evans, 2010; Kahneman, 2011). It is easy to see the importance of understanding the influence of culture, subculture or peer group on critical thinking for disciplines in the arts and humanities or social sciences. However, this understanding would also be essential for the "critically engaged citizen" (Davies and Barnett, 2015) graduating from any discipline. Accurate assessment of probability and risk is advocated in business studies, economics, and medicine, as well as being essential for everyday life. Nonetheless, Kahneman (2011) points out that even professionals in these sectors often make mistakes in their evaluation of probability and risk due to cognitive biases.

Critical thinking skills and dispositions may be mutually reinforcing, (Facione et al., 1995), but an understanding of the psychological and sociological factors that affect critical thinking might aid the development of both. An awareness of belief bias may result in greater intellectual honesty (Facione, 1990; Gupta and Ushur, 2012), self-awareness (Kuhn and Dean, 2004; Papp et al., 2014; Thomas and Lok, 2015; Thompson, 2002), critical self-reflection (Papp et al., 2014; Thomas and Lok, 2015), open-mindedness (Davies and Barnett, 2015; Facione, 1990; Thompson, 2002), fair-mindedness (Claris and Riley, 2012; Davies and Barnett, 2015; Facione, 1990), and tolerance of ambiguity (Claris and Riley, 2012; Davies and Barnett, 2015; Gupta and Ushur, 2012; Reid and Anderson, 2012). Developing these dispositions may enhance the skills of evaluating evidence and weighing arguments (both Cottrell, 2011). Learning about confirmation bias may foster the same dispositions as understanding belief bias, as well as a greater appreciation of multiple perspectives (Toplak et al., 2013). This could also help with the skills of evaluating evidence and weighing arguments.

An awareness of framing and its power may help to develop the dispositions of fair-mindedness, scepticism (Davies and Barnett, 2015), appreciation of multiple perspectives, and respect for alternative viewpoints (Davies and Barnett, 2015; Maclellan and Soden, 2011; Riggs and Hellyer-Riggs, 2014; Tanaka and Gilliland, 2016). This in turn might aid the skills of making inferences (Davies and Barnett, 2015), identifying persuasive devices and reflecting on issues in a structured way (both Cottrell, 2011).

Understanding the impact of culture and peer pressure on critical thinking may encourage students to resist authority or peer pressure (Claris and Riley, 2012; Fahim and

Hajimaghsoodi, 2014), and help them to develop independent thinking (Facione, 1990), empathy (Claris and Riley, 2012; Riggs and Hellyer-Riggs, 2014), appreciation of multiple perspectives, and respect for alternative viewpoints. This in turn may help them with the skills of identifying others' positions (Cottrell, 2011), identifying persuasive devices, making inferences, and reflecting on issues in a structured way.

Finally, exploring the barriers to accurately evaluating risk and probability may help students to develop self-awareness and critical self-reflection, as well as the skills of problem-solving, identifying assumptions (both Davies and Barnett, 2015), and analysis (Facione, 1990). As explained above, each of my five workshops deals with one of these areas that may impact critical thinking.

Students would have to use their metacognitive abilities to be aware of the effect of these factors on their thinking. Kuhn and Dean (2004) argue that "critical thinking … entails awareness of one's own thinking and reflection on the thinking of self and others as an object of cognition" (p.270). However, as mentioned earlier in this chapter, it is debated whether metacognition can be taught, and whether raising awareness of factors which affect human thinking such as biases has a perceptible impact (Battersby and Bailin, 2013; Croskerry, 2014; Kenyon, 2014; Maynes, 2017; Royce, Hayes and Schwartzstein, 2019; van Gelder, 2005).

Maclellan and Soden (2011) believe that metacognition "is not an automatic consequence of formal educational experiences" (p. 3), because people tend to make mental shortcuts that bypass their rational processing. Kuhn (1999, p. 18) notes that one can think uncritically about one's own thinking, and that such metacognitive processes should be "'self-correcting'" (citing Lipman, 1991). According to Kahneman, (2011), "[t]he best we can do is … learn to recognise situations in which mistakes are likely and try harder to avoid significant mistakes when stakes are high" (p. 28). Battersby and Bailin (2013) argue that "helping students to see the naturalness and allure of cognitive biases would be important for helping them to resist their pull" (p. 7).

There is evidence that raising awareness of possible bias helps this process, for example by asking students to justify their answers in reasoning tasks (Heiltjes et al. 2014), or by warning them to avoid bias in the instructions (Macpherson and Stanovich, 2007). Correia

(2016) and Kenyon (2014) argue that raising awareness of cognitive biases alone has not been proved sufficient to overcome them. However, Correia (2016) claims that combining awareness-raising with "debiasing strategies that take into account people's cognitive limitations" is more effective, for example, the "consider the opposite" strategy, where one examines hypotheses contradictory to one's own position (p. 106). Kenyon (2014) argues that raising awareness about bias "may be one of the many steps along a path to debiasing" (p. 348), and suggests a number of practical strategies for real-world situations that include a reminder to think critically and be vigilant about one's own prejudices. Battersby and Bailin (2013) argue that reframing issues, for example "to view marijuana use as a harm issue rather than as a crime issue", can encourage students to be open-minded to other views (p. 8). Kahneman (2011) points out that perceiving bias in others is easier than seeing it in oneself. However, understanding how flaws in rational thinking can arise is useful for the critical thinking skills of identifying or challenging hidden assumptions (Jones, 2015) and evaluating other people's arguments (Cottrell, 2011). These examples from the literature suggest that exploring the psychological and sociological factors that affect thinking with EAP students, as in my workshops, might help develop their critical skills and dispositions.

I contend that climate change could be a useful vehicle to explore these factors. Firstly, as discussed above, attitudes to climate change are often shaped by the same psychological and sociological factors as those that affect critical thinking skills and dispositions. Secondly, climate change not only affects every region of the world, but is relevant to a wide range of disciplines, from physics and engineering to economics and psychology, and this makes it a particularly apposite topic for the English for General Academic Purposes classroom. Moreover, arguably, one purpose of education in general and critical thinking in particular is to help students to become socially responsible and critically engaged citizens (Facione, 1990), consistent with the "criticality" model of critical thinking (Davies and Barnett, 2015). Macpherson and Stanovich (2007) include climate change amongst global problems that are exacerbated by critical thinking flaws such as confirmation and belief biases. Correia (2016), citing Rawls' (2000) view that "the realm of morals extends beyond action to reasoning, argumentation and belief", also argues that "biases may also be deemed illegitimate from an *ethical* standpoint [original emphasis], insofar as one person's cognitive illusions may have negative repercussions on other people's lives". This is certainly true of anthropogenic

climate change, where the aggregated actions of individuals can have unintended but potentially devastating impacts on the entire human race. This EAP classroom topic will also become an ever more pressing and relevant issue for students over time.

2.7 The research gap

The four areas of critical thinking, cognitive bias, climate change and English for Academic Purposes overlap to some extent. However, to my knowledge there have been no studies that connect all these areas together. (I appreciate that there may be such studies in languages I cannot read, although I would expect most EAP research to be published in English, so as to be accessible to practitioners from all backgrounds).

Cognitive psychologists and educationalists have, independently and within the traditions of their respective disciplines, come to quite similar conclusions about why it is so difficult for people to think rationally, or critically, and the work of the former is helping the latter to better understand barriers to critical thinking. There has been research into the relationship between critical thinking and cognitive biases such as belief bias and myside bias in university students (Macpherson and Stanovich, 2007; West et al., 2008) and in school pupils (Toplak et al., 2013). Some education literature discusses how exploring cognitive biases might make critical thinking instruction more effective (Battersby and Bailin, 2013; Croskerry, 2014; Kenyon, 2014; Maynes, 2017; Royce et al., 2019; van Gelder, 2005), although it appears that there have so far been few empirical studies exploring this possibility. Cook, Ellerton and Kinkead (2018) discuss strategies that can be used by science communicators and educators to counter misinformation about climate change by focusing on faulty reasoning. However, none of the studies above has focused on EAP students.

Extensive research demonstrates that the psychological and sociological factors that give rise to certain cognitive biases have a significant impact on attitudes to climate change, and have impeded effective action, as discussed in this chapter. As well as being an important social issue in itself, climate change is a popular topic in EAP, for example in exams such as IELTS, and in textbooks aiming to develop skills in reading, writing, speaking and listening, for example, Folse and Pugh (2015), Lynch (2004) and Zwier (2012). Activities for developing language skills in EAP may also include some focus on critical thinking. However, climate

change is not exploited as a vehicle for developing critical thinking as often as it might be, at least in EAP reading and writing textbooks (Aston, 2017).

To my knowledge there has been no study which at one and the same time:

- examines the outcomes of exploring, in a classroom setting, the psychological or sociological factors affecting critical thinking *in isolation*, that is, in sessions where these factors are the primary focus (as in the generalist approach);
- does this with English for (General) Academic Purposes students;
- uses climate change as a vehicle for exploring these factors rather than as a simply as a topic for a text or task.

This is the research gap which I aimed to fill with my own project.

3. Methodology

3.1 Introduction

In the Literature Review, I explored three models of critical thinking, and discussed how critical thinking might be fostered in students under each of these models, including by teachers of English for Academic Purposes. I then examined how certain psychological and sociological factors affecting critical thinking are related to skills, dispositions and criticality, and made links between these factors and barriers to action on climate change. I suggested some potential benefits of exploring the factors with students to help them with critical thinking. Finally, I identified my research gap. To my knowledge, no-one has examined the outcomes of exploring, in a classroom setting, the psychological or sociological factors affecting critical thinking in isolation with EAP students using climate change as a vehicle.

As mentioned in the Introduction chapter, my participants are likely to be the best judges of developments in their own mental processes. My research questions therefore ask what EAP students *understand* by critical thinking; how their *perceptions* of critical thinking might be affected by exploring factors that influence it; whether students *feel* that exploring these factors has an effect on their own thinking; and how using climate change as a vehicle might change their *perceptions* of this issue. My research therefore focuses on subjective understanding, perceptions and feelings. This focus has informed my epistemology and therefore my choice of methodology.

In this chapter, I will first explain the thinking behind my methodology, including my positionality, my epistemology, my justification for selecting my methods, and how I ensured trustworthiness. Then I will describe how I used these methods to generate and analyse my data, including some reflections on how they worked in practice. In brief, to generate the data I designed and delivered workshops exploring five areas of psychology or sociology that affect critical thinking, and then interviewed some of the attendees. These interviewees I have termed “participants”, as opposed to “students”, which refers to anyone who attended the workshops. (Participant details are tabulated on pp. 72-74). I also used observational notes in this project. I used thematic analysis and code development to

analyse the interview scripts, as described later in this chapter. I will finish with a discussion of how I resolved the ethical issues that arose in this research.

3.2 Methodological foundations

3.2.1 Positionality

Developing critical thinking has always been part of my role as an EAP teacher. Students are expected to apply "the ability to analyse, synthesise, interpret and evaluate ideas, information, situations, and texts" to academic discourses such as journal articles and lectures (Moore, 2019, p. 2), and they should display skills of argumentation and reasoning (Cottrell, 2011; Jones, 2015) in essays and debates. So critical thinking is relevant to the teaching of all four language skills (reading, writing, listening and speaking) in EAP. My long experience in the field bears out Dudley-Evans' claim that critical thinking in EAP is primarily seen as a set of practical skills (in Benesch, 2001). Understandably, international students in the UK know that their investment of time and money will come to nothing if they fail to display critical thinking in their assessments, and so are likely to take a pragmatic view of the acquisition of these skills. I, too, have tended to portray critical thinking to students as a set of tools to be quickly and efficiently applied to their work to bring it up to the required academic standards, instead of as a means of developing their critical dispositions or criticality over time. (For example, I used to tell students they could express any opinion in their essays as long as they supported it with evidence; I now feel I was encouraging confirmation bias rather than fostering open-mindedness or intellectual honesty). This instrumental view in EAP is reflected in what Moore (2019, p. 2) calls the "'situated' approach to the teaching of critical thinking, built around the different tasks and genres that students need to learn e.g. essays, critical reviews etc."

Critical thinking skills may be essential to academic work, but if practising them does not ultimately lead to any change in the student's perspective, attitudes or interaction with the world, in other words, in their dispositions, then these skills seem to me to operate at a fairly superficial level. Universities' "graduate attributes" (Howe, 2016, p. 873) suggest that

their aim is to develop character as well as skills, including critical dispositions such as self-awareness and ethical behaviour, consistent with the *Bildung* concept of education (Bleicher, 2006). Postgraduate students such as my participants are also expected to "[a]pply [their] subject or professional knowledge and skills to new settings, contexts and challenges beyond [their] studies: to make a difference in the world" (University of Sheffield, 2020). This recalls the "critically engaged citizen of the world" exemplifying criticality (Davies and Barnett, 2015, p. 16). Arguably, the power of higher education is severely diminished if it supplies students with qualifications but does not equip them to make this kind of positive difference, for example by engaging with global problems such as climate change.

I have long feared that our collective response to climate change does not match the scale of the crisis. My own framing of the problem has moved from seeing it as essentially an environmental threat, to a political issue, to a sociological and psychological one. Initially, I considered it to be primarily a scientific phenomenon whose negative effects could be tackled with existing technologies and a shift towards sustainability in the economy, energy generation, land use and infrastructure, as advocated by the Intergovernmental Panel on Climate Change [IPCC] (2014b). When this failed to happen, I blamed a lack of political will and the influence of "big business" like the fossil fuel industry. In a democracy, governments must listen to the concerns of the voting public to remain in power, so I became a political activist and campaigner, assuming (perhaps naïvely) that when people understood the severity of the problem, they would prioritise it and expect political parties to do so. However, for many years climate change was not generally considered to be a truly serious issue on a par with, for example, the state of the economy (APA, 2011; Kahneman, 2011; Marshall, 2014; Norgaard, 2009; Pigeon, 2012). Even now it is easily displaced in the political and public sphere by crises that appear to be more immediately pressing, such as Covid-19.

This is how I became interested in the psychology and sociology of climate change. As I read about the ways in which humans naturally think and interact, and how these hinder us from preventing ecological catastrophe, I saw parallels with the challenges of critical thinking for my students. Some of my in-sessional students, despite being hardworking and generally able, have done poorly in assessed work because of their failure to display critical thinking,

so I realised that it did not come naturally to most people (van Gelder, 2005); my climate-related reading on psychology and sociology has clarified why this might be. Meanwhile, my discovery of "Critical EAP" (Benesch, 2001) during my doctoral studies suggested to me that the English teacher might play a more significant role in students' educative journey than that of a language "technician" in the service of academics (Morgan, 2009, p. 88). So I feel justified in exploring critical thinking more deeply than is usual in EAP courses, particularly the factors that make it challenging and which are relevant to the development of a critical disposition, in the hope that this exploration might be of use to my participants and to other EAP professionals.

Therefore, my project has in part been an attempt to bring into the heart of my professional work a crucially important issue that I care about, but which has historically been given low priority in public discourse (APA, 2011; Kahneman, 2011; Marshall, 2014; Norgaard, 2009; Pigeon, 2012). I am aware of the danger of the EAP teacher trying to impose her own values on students (Morgan, 2009; Santos, 2001), particularly if these are deeply held. However, at all times in my project, both the workshops and in the interviews, I have avoided imposing any single view of climate change or any other issue, as can be seen in the sections below on "Ethical considerations", "Limitations", and "Designing the workshops".

3.2.2 Epistemology

As explained above, my research questions focus on *understanding* (RQ 1), *perceptions* (RQs 2 and 4) and *feelings* (RQ 3) about critical thinking and climate change. I could have set out to measure the students' critical thinking skills "objectively" before and after the course for the purposes of comparison, using an instrument such as the Watson-Glaser Critical Thinking Appraisal [WGCTA] (Watson and Glaser, 1980) or the California Critical Thinking Skills Test [CCTST] (Insight Assessment, 2020). I did not do so for several reasons.

Firstly, these tests are based on a narrow view of critical thinking as logic or rationality. Even assuming that critical thinking can be broken down into distinct units measurable by multiple choice tests like the WGCTA or the CCTST, these do not cover all the aspects of critical thinking that I am interested in, particularly dispositions such as the ability to resist peer pressure or respect for others' views. Secondly, becoming a critical thinker is a long

process, but my research project consisted of only six workshops over as many weeks. Such a short course might result in changes in participants' thinking or attitudes that they could discuss at interview, but which would not necessarily show up in a formal test. This is particularly relevant if raising awareness of influencing factors such as biases precedes changes in critical thinking in practice (Battersby and Bailin, 2013; Kahneman, 2011; Maclellan and Soden 2011). Thirdly, there are practical considerations; I would need to test all the participants as I would not know who would stay the course and volunteer to be interviewed; this would be time-consuming and probably discourage busy students from participating. Finally, I would have to use another instrument such as interviews anyway, to see what effect the course had on students' attitudes to climate change.

For these reasons, I decided to focus only on participants' *understanding*, *perceptions* and *feelings* about critical thinking and climate change, using a qualitative approach based on an interpretivist epistemology. I realised that my participants' expressions of these perceptions would have to undergo my own subjective interpretation. This process would be further complicated by the fact that most participants would not be speaking their first language. However, the international students who took part in my research project at the University of Sheffield's English Language Teaching Centre (ELTC) were used to reflection and expressing complex ideas in English from their studies at ELTC or their departments, and I had faith in their ability to do so at interview.

I did not always feel the need to "read between the lines" when analysing the interview transcripts, as I might if I was using a critical discourse approach (see "Transcription" below). For example, if when asked "What do you think critical thinking is?" a student said, "Questioning", I took this at face value. On the other hand, I acknowledge that some subjective interpretation was needed when categorising students' utterances. For instance, placing the following item under "argument building", with its references to a conclusion, use of (re)sources, logic and persuasion, seemed quite straightforward:

> it's like you can sort out your conclusion with the resources you have, the information you have, you can sort it out with the logical way … and use that to kind of persuade someone else.

However, placing this text in the same category required more personal judgement:

> … I'm not sure it was the right word, to manipulate people, or the – not manipulate, persuade people. Because you are discuss something, and you compare some idea, according yourself, your own, and you have to show something to other people. And you use some methods.

To ensure some consistency, I developed a system of rules to place my items in categories, described in Appendix 4. The item immediately above was placed in the "argument building" category because it "contains references to explaining one's point or position to others, or persuading others" (Appendix 4). This participant uses the word "persuade", and the second sentence suggests demonstrating one's stance to others.

3.2.3 Choice of methods

In this section I explain why I chose workshops, interviews and observations to generate my data, and thematic coding and analysis to analyse it (Boyatzis, 1998; Braun and Clarke, 2006; Cohen, Manion and Morrison, 2011; Wellington, 2015). I also discuss the advantages and disadvantages of each method, and how I attempted to mitigate the latter. Details of how I used these methods in my own research and my reflections afterwards are given in the "Methods" section below.

Why workshops?

My second research question asks how students' perceptions of critical thinking might be affected by exploring various factors which influence it. I judged that "exploration" of critical thinking through workshops was more appropriate than "transmission" of the relevant concepts to students via, for example, a series of lectures. Workshops would include time for independent thinking and self-reflection, and the discussions would allow participants to listen to and challenge each other's views, all of which is relevant to critical thinking. In addition, the learner-centred and interactive nature of workshops would be more engaging, and enable students to apply the concepts they were learning to their own values, perspectives and experience. I therefore took a mostly constructivist approach to the workshops. This approach proposes that individuals construct knowledge in a dynamic process "[a]s new understandings, experiences, actions and information are assimilated and

accommodated" (Fry, Ketteridge and Marshall, 2009, p.10). Students are therefore responsible for their own learning, which requires active involvement rather than passive absorption of information (Gergen, 1995). Building on existing knowledge results in deep learning (Biggs and Tang, 2011), which is lasting and transferrable to other contexts (Fry et al., 2009). More details on the application of the constructivist approach to the workshops are given under "Designing the workshops" below.

There were some potential drawbacks to using workshops. As attendance was voluntary, I did not know at the start of each course if I would have any students by the end, or if anyone would give up more of their time to be interviewed (although my fears were not realised, see "Running the workshops" below). I hoped that limiting the number and length of the workshops would make them more attractive. It was challenging to convey complex concepts in the limited time available using a constructivist approach, with its emphasis on student-focused activities, discussion and group work, so I had to balance these with some teacher-focused presentation (Fletcher, 2009; Spiro and DeSchryver, 2009).

For the workshops, I identified five main areas which influence critical thinking: belief bias; confirmation bias; framing; the influence of (sub)culture or peer group; and biases affecting the assessment of probability and risk. These were chosen largely for their relevance to higher education, but also because they are thought to be factors in humanity's failure to effectively deal with climate change (APA, 2011; Kahneman, cited in Marshall, 2014; Marshall, 2014; Norgaard, 2009; Pigeon, 2012). These human factors arguably affect how other crises, such as global pandemics and recessions, play out, so understanding them may help students become "critically engaged citizen[s]" (Davies and Barnett, 2015, p. 16).

For these reasons, climate change was used as a topic in all the workshops, although not exclusively. As students found in Workshop 3, it can be framed (for example) as an environmental, economic, political, religious, philosophical or health issue, or as an engineering or technical problem, and so is relevant to many disciplines. Even if students do not encounter climate change in their higher education studies, it is likely to affect their futures in some way.

Details of how the workshops were designed and revised are given below, in the section on "Designing the workshops".

Why (semi-structured) interviews?

Interviews are well suited to a qualitative research project based on an interpretivist epistemology, particularly one focusing on the participants' perceptions. Interviews allow the researcher to "probe an interviewee's thoughts, values, prejudices, views, feelings and perspectives" (Wellington, 2015, p. 137), which cannot be as easily accessed in (for example) ethnographic observations. Unlike asynchronous methods like written surveys, they allow participants to talk face-to-face and at length with the researcher or each other (in group interviews), and to "think aloud". Language is how we give shape to our thoughts, communicate them and collectively make sense of them, so talking (or writing) and thinking are inextricably linked (Mercer, 1995). In fact, the interviewees may not fully formulate their thoughts or feelings about the topic in hand until asked to put them into words. So the interviewer should be careful not to assume that she is tapping directly into the participant's lived experience or that the thoughts expressed exist independently of the interview. As Hammond and Wellington (2013) put it, "[t]he interview is not … 'the truth' as seen by the interviewee, but a discourse about a topic, and in the telling of the story the interviewee is making sense of the story" (p. 92).

In addition, the relationship between the interviewer and the interviewee can have a significant effect on the "two-way process" (Silverman, 2010, p. 47) of generating data (Maykut and Morehouse, 1994; Wellington, 2015). This relationship is already "asymmetrical" (Gubrium and Holstein, 2002, p. 3), and the power gap may be increased if the interviewer also has a teacher role, potentially leading the students/participants to say what they think the researcher wants to hear. This is particularly problematic if the participants feel they are being asked to evaluate the researcher's teaching, as may happen when I ask my interviewees about the impacts of my workshops on their critical thinking. In "Ethical considerations" below, I explain how I attempted to reduce the effect of the power imbalance in the classroom below, and I hoped that this would carry over into the interviews.

I began my research by using one-to-one interviews only, but decided to add the option of group interviews to the second and third courses after holding focus groups halfway through the first. These were held solely for obtaining feedback about the workshops, not

to generate data. However, I found that the students also talked spontaneously and extensively amongst themselves about their experience of learning about critical thinking in the workshops. As awareness of the researcher's presence can be somewhat inhibiting (Hammond and Wellington, 2013), I hoped that group interviews would help participants to forget my presence somewhat as they became absorbed in their own conversation, enabling them to direct the discussion and negotiate meaning themselves. In interpretivist epistemology, knowledge is seen as socially constructed (Greenbank, 2003; Hammond and Wellington, 2013; Mercer, 1995). Group interviews allow the participants to build on each other's contributions and so develop their ideas, thus co-constructing their understanding of their shared experience, in this case of my course and any impacts it might have had on them (albeit around my questions). On a practical level, group interviews save time by allowing a number of participants to be interviewed at once. The disadvantages of group interviews are that participants' responses might be subject to peer pressure to conform (Morgan, 2002), or that less confident individuals might feel inhibited from contributing (Wellington, 2015). However, I thought it likely that my participants would have received guidance, from ELTC or their departments, on how to conduct academic discussions (e.g. seminars) fairly and effectively, and I also deliberately kept the group size to three or four so that unequal participation would be more obvious. In the event the group interviews seemed to largely avoid these problems (see "The interviews" below).

I also offered one-to-one interviews throughout the project, partly so students could see me at a convenient time, but also to avoid the danger of peer pressure or inhibition. This meant forgoing the advantages of group interviews described above. I also had to be more careful not to over-direct the interview, for example by "leading questions or excessive prompting" (Wellington and Szczerbinski, 2007, p. 85). However, I had more time to listen to them, and they could let their thoughts unfold without interruption. It also meant I could make sure all the questions were answered to my satisfaction, which did not necessarily happen in the group interviews, as described below in my reflections on this process.

I chose to do semi-structured interviews, for which I wrote six basic questions, allowing some flexibility for both myself and the participants over what subjects were covered and in how much depth (Hammond and Wellington, 2013; Silverman, 2010; Wellington and Szczerbinski, 2007). I realised that having a few open questions would make it harder to

process the responses than if the interview was more highly structured (Wellington, 2015), but I hoped that this type of interview would allow me to generate data relevant to my research questions and to pursue unexpected topics that might emerge during the interview.

Why observations?

Wellington (2015, p. 248) describes observation as "an indispensable element in a mixture of methods". It would not have been suitable as a main research method for my project, which aimed to examine changes in participant perceptions; as Wellington argues, observation "cannot probe a person's motives or intentions, nor can it explore their perceptions, values and beliefs, except by inference from what is seen". Observation as a method is usually used to "gather 'live' data from naturally occurring social situations" (Cohen et al. 2011, p. 456) in order to analyse behaviour, but this was not my aim either. I used observation as a supplementary method for three principal reasons. The first was to ensure that the workshops conveyed the target concepts successfully. The second was to see if they worked as EAP sessions, for example, if the pace and staging were appropriate, the students found the activities engaging and the materials were at the right linguistic level. Thirdly, I wished to capture any "critical events" that might illuminate my analysis. Cohen et al. (2011), citing Wragg (1994, p. 64), describe these as "events that appear to the observer to have more interest than other ones … [because] they have an important insight to offer". My observation techniques were, therefore, less systematic than if I had been using this as my principal method. Cohen et al. (2011, p. 457) claim that while semi-structured observations gather data to elucidate a pre-existing "agenda of issues", they are "hypothesis-generating rather than hypothesis-testing". However, during my analysis I found my observational notes useful in refining my theories; examples are given in the "Observations" section under "Methods" below.

I made my observations principally by taking reflective notes on my lesson plans immediately after each workshop, and by video recording some sessions to watch later. In the workshops I was arguably acting as a "participant observer" (Cohen et al., 2011, p. 457), as I was simultaneously acting as classroom teacher and conducting my research. When

watching the video recordings I was able to act more as a "complete observer", allowing me to focus fully on what was happening in the session (Cohen et al., 2011, p. 457). I also invited other teachers to observe the workshops. As explained on p. 71, the purpose of these peer observations was to obtain feedback on how effectively I delivered the workshops, my colleagues were not acting as research participants or co-researchers. Finally, I took notes on conversations with students after the workshops (Cohen et al., 2011; Kawulich, 2005), both with the students' written permission. These four observational methods; annotations on the lesson plans, video recordings, observations by colleagues, and summaries of conversations with students, are all detailed on p. 78 in the section on observational data.

Observation as a research method has some drawbacks. As in other qualitative techniques, the data gathering is subject to the researcher's selective focus and memory, and the analysis to her interpretation (Cohen et al., 2011). Cohen et al. note that "we sometimes interpret the situation then record our interpretations rather than the phenomenon" (2011, p. 473). As I was using observation to help me develop my hypotheses from the interview data, this was perhaps inevitable and not necessarily problematic. Videorecording helps with the accurate recording of events, but has its own drawbacks. Cohen et al. (2011) argue that video cameras can be "highly selective … [w]hilst a human observer can turn his/her attention to an event that occurs, for example, in a different part of the classroom" (p. 470). This is why I took my own notes and had observers watch me. In addition, I needed to be able to monitor the students in their groups closely to judge how they were reacting to the activities and materials, which a camera cannot do.

Why thematic analysis and code development?

I chose to use thematic analysis and coding development as this is a tried and tested method for making sense of interview data (Boyatzis, 1998; Braun and Clarke, 2006; Cohen et al., 2011; Wellington, 2015). Braun and Clarke (2006) describe thematic analysis as "a method for identifying, analysing and reporting patterns (themes) within data" (p. 79), and state that a theme "captures something important about the data in relation to the research question, and represents some level of *patterned* response or meaning within the data set"

(p. 82, their emphasis). In this technique, segments of text from the transcripts that are linked by a common topic or idea are ascribed the same label or "code". The researcher then identifies patterns in the codes in order to draw broad conclusions from the data. The codes may originate in existing theory or research (deductive coding) or it may seem that they are suggested by the data itself (inductive coding) (Boyatzis, 1998; Hammond and Wellington, 2013). Wellington (2015) argues that in practice, a mix of inductive and deductive coding is generally used, and this was the case in my own analysis, as described below in the "Methods" section.

My analysis followed some of the stages of thematic analysis and code development as suggested for research in education (Cohen et al., 2011; Wellington, 2015) and in psychology (Braun and Clark, 2006). According to all these writers, the early stages of thematic analysis are as follows. The first step is immersion in the data in order to become thoroughly familiar with it, with Braun and Clarke (2006) claiming that transcribing interview data is particularly useful for this. This is followed by the development of categories or codes; in this process categories are identified and then constantly refined or discarded, merged or split, and items moved from one to the other. Finally, the researcher looks for overarching patterns or "themes" (Braun and Clarke, 2006, p. 79), which are used to answer the research questions.

My own analysis went through these three stages of immersion, iterative code-development and pattern-seeking. However, as Braun and Clarke note, "there is no clear agreement about what thematic analysis is and how you go about doing it" (2006, p. 79). So my analytic process differed from those outlined by Wellington (2015), Cohen et al. (2011) and Braun and Clarke (2006) in some respects, as discussed below.

Braun and Clarke (2006) suggest that the development of a system of codes or categories is preparation for the more important stage of identifying and refining more general patterns or "themes" (p. 79). They advise the researcher to organise the codes or categories into a series of progressively simpler diagrams to aid this process of refinement, and then relate the resulting "themes" to the research questions. In the examples of thematic analysis taken from their own field of psychology, the research focus is fairly open, for example: "How is lesbian and gay parenting constructed?" (p. 85). So the data generated from the interviews, and the "themes" that might be identified from these, are quite unpredictable,

meaning that the researcher has to develop a framework that can make sense of the various codes or categories. In my study, I compared participant perceptions of critical thinking and climate change before and after my course, providing a simple, ready-made analytical framework. When I finished the code development stage, I put the findings into a table organised according to research question and found that there were only a handful of categories that had sufficient salience to be considered in the analysis (see pp. 81 - 82 for how I measured salience). Three categories were related to the first research question, five categories to the second, six to the third and seven to the fourth. At this stage, I felt I could answer my research questions with the categories I had already identified, and did not feel the need to further condense them into overarching "themes" (Braun and Clarke, 2006, p. 70). However, once I started to identify patterns in the categories, I was able to apply the theories from the Literature Review relating to critical thinking and climate change to them, as discussed in the Analysis and Discussion chapters.

Cohen et al. (2011) suggest that thematic analysis starts with "open coding" (p. 561), or attaching descriptive labels to segments of text. These initial codes might then be assigned to more interpretative "analytic codes", or recombined into "axial codes" (p. 561), which are organised around common concepts, such as causal conditions or consequences (Cohen et al., 2011). Analytic and axial coding therefore both entail a deeper level of interpretation than open or descriptive coding. However, Cohen et al. claim that descriptive codes "might include ... perspectives held by subjects" (2011, p. 560). Participant perspectives are the focus of my research questions, and most of my categories (or codes) are indeed quite descriptive. Although all coding requires an element of interpretation, I only had to analyse items in two categories in any depth in order to assign them: "critical thinking as a process" and "participant's knowledge about climate change" (see the Findings and Data Analysis chapter). With regards to levels of interpretation in coding, Braun and Clarke (2006, p. 84) distinguish between "semantic" or "latent" approaches:

> With a semantic approach, the themes are identified within the explicit or surface meanings of the data, and the analyst is not looking for anything beyond what a participant has said or what has been written. Ideally, the analytic process involves a progression from description, where the data have simply been organized to show patterns in semantic content, and summarized, to interpretation, where there is an attempt to theorize the significance of the patterns and their broader meanings and implications … In contrast, a thematic analysis at the latent level goes beyond the semantic content of the data, and starts to identify or

> examine the underlying ideas, assumptions, and conceptualizations - and ideologies - that are theorized as shaping or informing the semantic content of the data

My coding process deals mostly with such "explicit or surface meanings". As explained above in the section on "Epistemology", when I asked interviewees about their perceptions of critical thinking or climate change, how the workshops might have altered these, and changes they perceived in their own thinking, I accepted their answers at face value. My interpretation came later, when I looked for patterns and related them to the theoretical framework outlined in the Literature Review. My approach to coding was therefore a semantic one, in Braun and Clarke's (2006) terminology, and I did not see a need to organise my descriptive codes under analytical or axial codes suggested by Cohen et al. (2011) to aid my analysis.

For Wellington (2015), the next step after code development is to "integrate the data … and … locate one's own data in existing work" (p. 263). Wellington suggests that researchers achieve the latter by comparing or contrasting the categories from their thematic analyses, or their entire methodologies, with those of other studies, presumably those which cover similar ground to their own. As I explained in the Literature Review, I am not aware of any other research projects that examine the effects of exploring factors influencing critical thinking on EAP students (or on higher education students of any type). So I am following Wellington's third suggestion only, which is to explore how theories and frameworks from other inquiries can be applied to my own research. In the Literature Review, I discuss how I have used research in the fields of psychology and sociology to develop a theoretical framework for my own project.

I used thematic coding and analysis partly to create some distance between myself and the raw data, which I felt was necessary due to my personal stake in the project. I invested a great deal of time and effort in the sessions, which presented an angle on critical thinking that I believe to be unusual in EAP and which I thought students might find enlightening. I also hoped that they would have a deeper understanding of climate change, an issue about which I have strong feelings. If I had simply read through each interview script to form an impression of participants' perceptions and attitudes relevant to the research questions, I might have been unduly influenced by highly positive feedback on the effects of the workshops on critical thinking (for example, from Violet, Lohita and Max), or reports of

profound changes in attitude to climate change (for example from Hamra), which were given by a minority of participants. I may also have ignored or played down elements I did not wish to see, for example that some participants still did not care much about climate change or found the workshops difficult. Although naturally I read through the original transcripts, I felt that the process of atomising them into items which were then redistributed into categories gave me a much more distanced and accurate view of the range of perceptions and attitudes expressed by the participants.

One drawback of the use of thematic analysis and code development for interview data is possible bias. The researcher is actively looking patterns and connections in the data; these do not emerge of their own accord (Brice, 2005). So the researcher must try to avoid the "projection" of her own values or attitudes onto the participants (Boyatzis, 1998, p. 13). In the section on "Confirmability" below and in Appendix 4, I demonstrate how I tried to minimise bias by devising rules governing the assignment of each item to a category, and by tabulating the findings in numerical form so that alternative interpretations of the data can be made.

3.2.4 Trustworthiness

Although research, including in education, is often evaluated in terms of "reliability" and "validity", the application of these concepts to qualitative research methods such as interviews is somewhat problematic (Wellington, 2015). Wellington defines reliability as "the extent to which a research method or procedure functions consistently and accurately by yielding the same results at different times or when used by different researchers", and validity as "the extent to which an enquiry, a method, test, technique or instrument measures what it sets out or purports to measure" (2015, pp. 344 – 345).

Holstein and Gubrium (2004) criticise the traditional view of the interview as a "one-way pipeline for transporting knowledge" (p. 143) from a passive subject to a neutral interviewer; instead they regard it as an active process where researchers and participants spontaneously create meaning together. They accordingly reject the notion that the "truth of interview responses might be assessed in terms of reliability; the extent to which questioning yields the same answers whenever and wherever it is carried out, and validity,

the extent to which the enquiry yields the 'correct' answers" (p. 145). As the relationship between the interviewee and interviewer can significantly affect their conversation (Maykut and Morehouse, 1994; Wellington, 2015), it is unlikely that exactly the same data would be generated if the respondent was interviewed by somebody else at another time, as suggested by the traditional definition of reliability. If meaning is generated spontaneously with each encounter, even identical questions put to the same participants by the same interviewer might give different results on a different occasion. Therefore there are no consistently "correct" answers to satisfy the definition of validity above (Holstein and Gubrium, 2004).

The concept of "trustworthiness" is often used to evaluate the quality of qualitative research instead of "reliability" and "validity" (Lincoln and Guba, 1985, cited in Maykut and Moorehouse, 1994, p. 133). Hammond and Wellington, citing Lincoln and Guba (1985), maintain that "a trustworthy account is one that is confirmable, credible, transferable and dependable" (2013, p. 147). Below I discuss my research methods in relation to each of these four concepts.

Credibility

Hammond and Wellington define credibility as "how likely something is to be the case", adding that "credibility is enhanced if the researcher has had prolonged engagement with participants [and] can show rigorous and extensive data analysis" (2013, p. 164). I was engaged in teaching and interviewing my participants for up to seven weeks, and my data analysis is described under "Methods" below and in the Findings and Data Analysis chapter, where its rigor and extent may be judged. The credibility of my workshops, and my delivery of them, might be evaluated by considering the likelihood that key points about the psychological and sociological factors impacting critical thinking were conveyed in a way that was comprehensible and engaging for the students, without distorting or "dumbing down" the theory behind them. I have included (in Appendix 2) a commentary on each workshop that includes an explanation of its theoretical underpinning. I believe that my 20 years' experience in teaching EAP should give some credibility to my ability to deliver such a course effectively, and the feedback from some of the participants suggested that I

succeeded (see the section “Workshops are useful or engaging” in the Findings and Data Analysis chapter).

Dependability

Hammond and Wellington state that dependability “considers the process of data collection, data analysis and theory generation” and add that “[t]heoretically at least, another researcher could follow the steps taken in the original study” (2013, p. 147). For each workshop, I designed a complete set of activities and materials with answer keys where appropriate, a detailed lesson plan and a commentary explaining the thinking behind it. Any competent EAP teacher should be able to use these in the same way I did. Indeed, some of my colleagues have already shown an interest in using some of the sessions with their own students (although at the time of writing Covid-19 restrictions have so far prevented this). My interview questions are set out in the section “The interviews” below, and can be replicated by any researcher (although, as discussed above, with no guarantee of receiving similar answers).

My interview techniques were intended to maximise the dependability of my data. I asked the same six questions in all 14 interviews, with very little variation. 30 years of teaching and teacher-training have ingrained the habit of patiently eliciting responses from students, and I tried not to lead the participants’ answers. The recordings and transcripts suggest I was successful in this. For example, in the one-to-one interviews, I asked mostly open questions, such as “What did you think about climate change before starting the course?”, or “Is there anything else you want to say about the course?” If necessary, I followed these up with other non-leading questions, such as “And what about now?” or “Do you have any examples of that?”

Confirmability

Hammond and Wellington maintain that “confirmability is generally taken as a measure of how well the findings are supported by the data” (2013, p. 147). As my data consists of items taken from the interview scripts and categorised for analysis, I have demonstrated

how this was done in Appendix 4 (although it was impractical to provide an exhaustive list of all the items in each category). I have also drawn up tables showing the frequency with which the topic of each category was mentioned, and by how many participants. This gives readers access to one aspect of the "raw" data on which I based my interpretation, and allows them to judge for themselves whether I have given a convincing account of the patterns I identified. Braun and Clarke (2006) recommend that "[y]our write-up must provide sufficient evidence of the themes within the data – i.e., enough data extracts to demonstrate the prevalence of the theme" and recommend choosing "particularly vivid examples, or extracts which capture the essence of the point you are demonstrating" (p. 93). I have included quotations from the items in the prose part of my Findings and Data Analysis chapter, and also in the Discussion chapter, in order to demonstrate nuances in the data that cannot be seen from the numbers alone, and so support some of the conclusions I have drawn in my findings. For example, in the Findings and Data Analysis chapter, I quote items in the category of "climate change as a collective problem" to show that this covers different views of climate change as, for example: a global threat needing international co-operation; a domestic issue for national governments; or a social issue requiring grassroots activism. In the Discussion chapter, I give examples of items from the category "framing" to demonstrate that some relate to the framing of information, some to awareness of one's own framing, and others to understanding other people's viewpoints. Although I have necessarily been selective in my examples, they give the reader another opportunity to assess whether my findings are supported by this data.

Transferability

According to Hammond and Wellington (2013, p. 147), "[t]ransferability refers to the degree to which the findings of one's enquiry can apply beyond the bounds of the project". They link this to "relatability":

> A study becomes relatable when there is enough background detail, appropriately presented, to enable the practitioner and/or fellow researcher to recognise a case as similar to their own. A study that is relatable … helps him or her assess the likely consequences of choosing to follow the actions reported in that study (p. 80).

My project was conducted in a classroom setting that would be familiar to many EAP professionals. My focus, critical thinking, is relevant to all the disciplines for which their students may be preparing (Davies, 2013; Davies and Barnett, 2015; Ennis, 2015; Moore, 2011), and so it is reasonable to assume that EAP teachers and students might be interested in factors that affect its development. Most of my participants were from China, with students from Saudi Arabia and Taiwan forming the next largest contingents. Students from China form the single largest group of international students at British universities, with Saudi Arabia also in the top ten (HESA, 2020). Taiwan also sends significant numbers of students to UK universities (Universities UK International, 2018). So other EAP teachers who work at universities in Britain (or elsewhere) and whose classes have similar national profiles might find the conclusions of my study of interest, or applicable to their own situations.

Hammond and Wellington (2013, p. 147) maintain that

> A trustworthy account follows systematic and rigorous procedures; it does not represent the truth of a situation; there is no single truth to describe, but the account is worth paying more attention to than one constructed on everyday observation or anecdotal reportage.

I hope that by demonstrating how I have fulfilled Hammond and Wellington's four requirements of trustworthiness (2013) above, I have shown my research project to be systematic, rigorous and worthy of attention.

3.3 Methods

3.3.1 Data generation

This section details how I used the above methods to generate and analyse my data, and gives my reflections on how they worked in practice.

Designing the workshops

Each of the first five 90-minute workshops on my course covered one area which has an impact on critical thinking (see the Literature Review, pp. 25-30); the sixth was a review

session. Each workshop stood alone, but also led naturally onto the next. I read thoroughly around the five areas to ensure that the workshops had a solid theoretical underpinning, and wrote commentaries justifying my approach and choice of activities (see Appendix 2). Although climate change appeared in all the workshops, they covered many other topics, partly to hold students' interest, but also because the factors are applicable to a wide range of situations. As an extension to the workshop discussions, I set optional "thinking homework". In the latter two courses I finished each session with a "take home message", which summarised the main points of the workshop.

All the workshops followed the general principles of English language teaching. For example, difficult vocabulary was revised before the activities, simpler concepts were covered before more complex ones, and the activities were designed to be engaging (Scrivener, 2011). The course also followed constructivist principles to some extent. In order to convey complex ideas efficiently (Spiro and DeSchryver, 2009) and concisely (Fletcher, 2009), I sometimes had to do some teacher-focused presentation, although I incorporated student participation where possible, for example through questions and elicitation. However, the aim was to maximise the time available for learner-focused activity, particularly through collaborative and experiential learning, both of which are based on constructivist theory.

Collaborative learning took place in every workshop through group work and discussion. Gergen (1995) argues that "[o]ne learns through engaging, incorporating and critically exploring the views of others, and new possibilities of interpretation are opened through the interaction" (p. 34). Experiential learning "implies that we all bring to learning situations our own knowledge, ideas, beliefs and practices at different levels of elaboration that should in turn be amended by experience" (Fry et al., 2009, p. 15). My students were encouraged to relate the psychological and sociological concepts they encountered to their previous experience of the world and then to consider their application to their own lives and thought processes. For example, in Workshop 2, they explored how confirmation bias can reinforce gender stereotyping, and were then invited to re-examine one of their personal beliefs by deliberately looking for evidence that contradicted it. Role plays and case studies also constitute a kind of vicarious experiential learning (Fry et al., 2009). In Workshop 5, I gave the students simplified versions of real-life psychological experiments

demonstrating the effects of framing on decisions made by medical and public health professionals (Kahneman, 2011). Students were asked to discuss what decision they would make if they were in the place of these professionals, as in a role play. The description of how cultural identity has informed the contrasting attitudes to climate change of the American political group the Tea Party (Marshall, 2014) and the Norwegian citizens in Norgaard's (2006) investigation could be seen as an example of a case study.

Knowing of no similar courses where EAP students explore psychological and sociological factors that affect critical thinking, I prepared the workshops from scratch, which took about 30 hours each. This meant that, unusually for me, I had to do virtually all this preparation before I met my participants for the first time, making adjustments later between workshops and courses in response to students' reactions to the activities and materials. (Please see p. 70 and Appendix 3 for details of minor differences between courses, and Appendix 3 for a summary of the adjustments and the reasons for making them).

Below is a synopsis of the "final" version (from the last course) of each workshop, giving the main activities only. (See Appendix 2 for more detailed commentaries on the workshops).

Workshop 1: "Source reliability"

The aim of this workshop was to demonstrate that when faced with contradictory information, students should consider the reliability of their sources. A second aim was to raise students' awareness of belief bias, including possibly their own.

Students were given a quiz on climate change with True/False or multiple-choice answers (see Appendix 2). For example:

> If we don't cut our emissions, how much will the temperature rise by 2100?
> a) 2^{o} C or less b) about 4^{o} C c) about 6^{o} C.

They discussed the answers in groups, without smartphones. Next, I reviewed with the class how to judge the reliability of a website, article or book, before telling them that each possible answer in the quiz was backed by a respectable-looking source. Students then received information about all the sources (although not which answers they supported) and had to determine the quality of each as an authority on climate change. Finally, they

were told which sources supported each answer, and discussed in groups whether they would change any of their original answers in the light of this information. Refusal to reconsider an answer that turned out to be unsupported by reliable sources (according to the student's own judgement) would suggest a strong belief bias.

Homework: Discuss questions on belief bias, disagreement between experts, and funding of "independent" institutions (online).

Workshop 2: "Confirmation Bias"

The aim of this workshop was to raise students' awareness of confirmation bias, including their own.

I used the Wason Rule Discovery Test (see Appendix 2) to demonstrate confirmation bias, and showed video clips giving definitions. The students then gave examples of confirmation bias in daily life. Next, they noted their answers to three questions relating to stereotypes in gender and communication, such as "Women talk more than men. True or false?", and discussed in groups why they held these beliefs. Then I showed them evidence from meta-studies in sociolinguistics that contradict gender stereotypes common across cultures, and asked them to discuss with their groups if they would reconsider any of their original answers in the light of this evidence. To demonstrate awareness of my own confirmation bias, I showed them my copy of feminist linguist Deborah Cameron's "The Myth of Mars and Venus", from which this evidence was taken.

Finally, I gave the students a list of quotations where writers used single weather events to argue that climate change was or was not happening (arguably demonstrating confirmation bias on both sides), and asked them to discuss in groups whether they thought this was justified in each case.

Homework: Choose a belief you hold and seek out evidence that contradicts it. Report back. (I did this homework too).

Workshop 3: "Framing"

The aim of this workshop was to raise students' awareness of framing, including its effects on their own thinking.

First, students discussed in groups the homework from Workshop 2. Next, games, such as mock bets, were used to demonstrate positive/negative framing and loss aversion. Then, in groups, the students did simplified versions of real psychological experiments (from Kahneman, 2011), the original results of which showed that even the decisions of doctors and public health professionals can be influenced by such framing. Next, I demonstrated how a single issue can be framed in many ways by gradually revealing, section by section, the 1768 painting *An Experiment on a Bird in the Air Pump* by Joseph Wright of Derby, while students speculated on the painter's message. Then students discussed how the whole painting might be interpreted differently by, for example, scientists, animal lovers, or historians.

Students then circulated round the classroom to read various quotations stuck to the walls, and considered how climate change had been framed in each (for example as a moral, economic, or health issue). Finally, the students were asked to discuss how people holding one of five different world-views might frame social issues such as homelessness.

Homework: Consider how the framing of other social issues, e.g. the surveillance society, might be influenced by five different world-views (see Appendix 2).

Workshop 4: "Cultures, tribes and taboos"

The aim of this workshop was to raise awareness of the influence of culture, in-groups and peer pressure on independent thinking.

The students discussed the reasons for the opposing attitudes of pairs of countries to issues such as gun control or drug addiction. I introduced the theory (see Appendix 2) that explains such differences by classifying cultures as predominantly egalitarian or hierarchical, individualist or collective. I invited students to place their own culture and themselves (separately) on these clines, noting any disparities, and to discuss this in groups. Next, I

explained that in British universities, critical thinking includes thinking independently in the face of social pressure.

Moving on to tribes and in- /out-groups, I explained how religious and ethnic partisanship in my home city of Glasgow is reflected in football club affiliations. Then students discussed how their own in-groups might restrict what they could do, say or think. Finally, we looked at how cultural identity affects the attitudes to climate change of both Tea Party Republicans in the USA, and "nature-loving" Norwegians who benefit from their country's oil revenue. We finished with the concept of the "elephant in the room".

Homework: Discuss "elephants" in your culture (online).

Workshop 5: "Assessing probability and risk"

The aim of this workshop was to raise awareness of factors affecting the assessment of probability and risk.

Games were used to demonstrate how cognitive biases, i.e. the gambler's fallacy, stereotyping and disregarding regression to the mean, affect our assessment of probability. Then I used a risk matrix to demonstrate that:

risk (e.g. from illness) = probability x harmfulness.

As "harmfulness" is subjective, risk assessment is influenced by affective or "human" factors.

Pairs of sentences with similar meaning but different wording were used to demonstrate the influence of language on perceptions of harmfulness, and statistics about flooding in India were contrasted with a video showing the local impacts of a flood to demonstrate how imagery and personal stories shape perceptions of risk. Then I gave the students real-world examples of other factors affecting risk perception; i.e. optimism, future discounting, availability bias and the bystander effect, and asked them to try to identify these factors in groups. Finally, students placed climate change on the risk matrix according to data from Workshop 1 (suggesting a high risk), and again according to the salience of the issue in their

own lives and social circle (a much lower perceived risk), before discussing which of the factors discussed in the workshop might account for this disparity.

Homework: Revision of the five workshops so far.

Workshop 6: "Review"

The aim of this workshop was to review the concepts from the previous five workshops and to apply them to reading texts.

Students completed a quiz on the previous five workshops in groups. I gave the class feedback and directed them to the workshop materials online for later revision if desired. Students were then given an adapted report from a British tabloid newspaper on the devastating global heatwaves and wildfires of the summer of 2018, and a list of critical questions incorporating concepts from the five workshops, i.e. use of sources and evidence, balance, framing, audience, and use of emotional language. They discussed the questions in groups before reporting their answers to the class for discussion.

Finally, I gave students adaptations of an opinion piece from a climate change denier writing in another newspaper and an extract from an IPCC report, in case they wanted to analyse these at home.

Homework: Optional text analysis (see above).

Recruiting students and participants

As I explained in the introduction to this chapter, I am using the word "students" to refer to people who attended my workshops, and "participants" for those who were interviewed to generate data for this study. Participants are referred to by their pseudonyms throughout this chapter.

To recruit students for all three courses, I mainly targeted two programmes at ELTC, the Pre-Sessional (PS) programme, where international students study English full-time in preparation for their degree courses, and the in-sessional English Language Support (ELS) programme, which runs part-time EAP classes for students already in their departments. I

visited PS and ELS classes with flyers and posters advertising my course, and my colleagues kindly promoted my course in their classes when I was not able to visit in person. In my publicity I introduced myself; briefly explained the purpose of the research; gave the times and venue of the workshops; and invited them to contact me by email, come to an information meeting, or both.

I sent a link to an online sign-up sheet when I emailed students to publicise the courses, or when replying to students who had seen my contact details on the flyers or posters. I asked these students to attend the information session if they could; if they could not, I sent them the information sheet and the consent form. I put students on the sign-up sheet myself if they came to the information session and completed a consent form there. In the interests of fairness, I aimed to fill the classes on a first-come, first-served basis, so for each course, I took the first 16 to 20 students who both signed up/attended the information session and returned a completed consent form, and I put the rest on a waiting list. I also invited students to join the second course if they had signed up to the first one but had only managed one or two sessions, or none. One student, Cyan, took up this offer, and was among the interviewees for both these courses.

My research participants were drawn from students who attended the three critical thinking courses. These participants studied or planned to study a range of disciplines, including: computer science, economics, education, information technology, journalism, law, management, medicine, politics, sociology, and urban studies and planning. I have not included this information amongst my data as the relationship between critical thinking and academic discipline is not the focus of this thesis (but see p. 177, “Recommendations for further research”). Although home students and speakers of English as a first language would have been welcome at my workshops, no such students joined (with the possible exception of Lohita from India; I did not ask what her first language was, as the relationship between language on critical thinking was also outside the scope of the thesis). Participant tables are given in on pp. 72 - 74.

The composition of the cohorts on the three courses varied somewhat in terms of programme, nationality and time spent studying in the UK (see the participant tables on pp. 72 - 74). Most students in the workshops, and therefore research participants, were from either the Pre-Sessional (PS) or the in-sessional (ELS) programme, with one exception (Max

from the October start course, see below). I had taught two of the participants from the February start cohort, Jade and Melina, on another programme, but as I was not involved in formally assessing them, I did not think this presented an ethical issue. One participant on the October start course, Hamza, later joined the Pre-Sessional class I taught in May and June of 2020, but I made sure I was not involved in his assessment. I have never taught or assessed any of the other research participants.

Although there was strong interest in all the courses, attendance fluctuated, starting at 15 or 20 or more and falling towards the end of the course (as expected) to about six or seven. Each course started with sufficient numbers, but I knew that some students would drop out or skip sessions because of the pressures of their regular studies, and others might find that the course did not fit their expectations or perceived needs. One solution to this might have been to form a very large class of 30 or more at the beginning of each course, comprising every eligible student, so that numbers would be unlikely to fall below a sustainable level (of perhaps five or six). This would have meant the keenest students would be guaranteed access to all six workshops instead of potentially being put on a waiting list for the first two weeks. However, the available classrooms at ELTC could only comfortably accommodate 16 to 20 students, and anyway I felt my experimental approach to critical thinking would be difficult to implement with a larger class.

Although I was successful in recruiting enough students for the workshops, they were restricted to those who were available on Friday afternoons, already interested in critical thinking, and found the approach I used in the workshops useful. This sampling issue imposes a limitation on the generalisability of my research, as my approach may not suit all EAP students. This is revisited in the Discussion chapter.

In addition, it was difficult to maintain a core of regular attenders who would have enough experience of the workshops to be worth interviewing. (Under the conditions of my ethical approval, I could not seek to make the workshops compulsory). Ideally, I would have liked to recruit one cohort consisting only of PS students and another only of ELS students, so I could compare the effects of the course on different student types. In the event, there were enough PS students in the February start cohort to have excluded students from other programmes if I had wished, and in October there were enough ELS students to do so. However, most students did not come every week and I had to top up numbers from the

waiting list two weeks into the February and October start courses. If I had deliberately confined recruitment for any of the courses to one type of EAP student, I would have struggled to fill them.

Running the workshops

To generate my data, I ran three courses of workshops in 2019, starting in February, May and October. The first was originally meant to be the pilot course, held in order to check the effectiveness of the workshops and interview questions and to see if I could recruit enough workshop students and research participants. However, in the event, I had viable numbers in all the sessions in the first course, and six interviewees. As described below in the section on "Observations", I reflected on each workshop after delivery, watched those I had recorded and sought advice from observing teachers. I also held a focus group half-way through the February start course to hear students' feedback. The minor changes made to the workshops between courses, as described in Appendix 3, were mostly intended to improve the "flow" of the session, for example adding vocabulary explanations, reordering stages, or moving them from the lesson to the homework. My reflections and observations, and feedback from teachers and students, reassured me that the first course was close enough in quality to the latter courses to be included in the main project.

The interviews for the February start course used the same questions as the other two courses, and yielded rich and varied data from which most of my categories for analysis were created, so I considered this data suitable for inclusion in the main research project. I gave a Pre-Course Task to the May and October start cohorts, with three questions they were required to answer before they joined. Students had to give their own definition of critical thinking; say whether they thought themselves good critical thinkers, giving reasons for their answer; and describe how they felt about climate change. The answers would be compared to what they said at interview. I did not give a Pre-Course Task to the February start cohort, but I did ask interviewees in all cohorts to make this comparison in their own minds and tell me of any changes they perceived, which they all did. For example, Violet said that before the course she had not known that she had confirmation bias, and Hamra said that she had not felt climate change to be dangerous (although she did now); both

these students were on the first course. Agnes (from the second course) said at interview that she had been unaware before the course that there were so many different views of climate change, and Hilary (from the third course) said at interview that she had not known about framing. In all these cases and more, I treated these responses as relating to their perceptions before the course, even though they occurred at interview and not in the Pre-Course Task. This is why I felt the omission of the Pre-Course Task in February did not mean that the data about their perceptions before the course was unusable.

I ran the workshops at the ELTC weekly on Friday afternoon to fit most students' schedules. I encouraged the students to come to as many workshops as they could but reassured them that it was fine to come to only one or two. After each session I made the materials available to all students online so they could revise or catch up. For the latter two courses I offered optional "thinking" homework, including discussions on the online platform Padlet, although the take-up for these was low.

Most of the workshops were observed by other teachers, who gave helpful feedback on (for example) staging, student engagement, clarity of instructions, and effectiveness of materials and activities. As detailed below in "The observational data", I took my own notes after the workshops, too. Because I had trouble remembering everything that happened in the sessions, I started video recording them (with the participants' permission). I watched these recordings afterwards partly to pick up details of "critical events" (Cohen et al., 2011, p. 464), but also to catch student contributions that I had not focused on sufficiently at the time, or to check my teaching technique, for example that I was giving enough time for responses, allowing students to take the lead in discussions, and encouraging all students to contribute.

As I expected, class numbers were high for the first lesson and dropped off as the course progressed, so I had to top up the numbers from the waiting list as described above in "Recruiting students and participants". I emailed those who dropped out of the first course to ask why, but received no replies. I suspect that reasons included time pressure from their regular studies, or the course not being what they expected. In general, students who stayed seemed to find the workshops enjoyable and useful (see p.117 - 118). However, I regret that there was never quite enough time in the sessions for discussion.

The interviews

As explained earlier in this chapter (p. 51), I offered one-to-one interviews to participants in all three cohorts, and the option of group interviews to the two later cohorts. All the interviews took place at ELTC at mutually convenient times, starting immediately after Workshop 5 and finishing a week or two after the end of each course. There were six one-to-one interviews for the February start course, and two one-to-one interviews and two group interviews with three and four participants respectively for each of the other two courses. One participant, Cyan, attended some workshops in each of the first and second courses and was interviewed, once alone and once in a group, after each. So, although there were six interviewees for the February start course and nine for each of the others, the total number across all three courses was 23.

Information about the participants is given in Tables 1a, 1b and 1c below. Each table shows the participants from one course, and is followed by notes on what distinguishes this group from the other two, to elucidate the discussion on cohort differences in the Findings and Data Analysis chapter. Note that I do not know exactly when some participants started their studies at the University; in these cases information under "length of study at Sheffield University" is given as a range.

Table 1a: Participant information for the February start course

February start course						
Name	**Program**	**Nationality**	**Previous time at Sheffield University**	**Attended Summer School?**	**Workshops attended**	**Interview type**
Hamra	PS	Saudi	3 weeks to 4 months*	No	2, 3, 4, 5, 6	One to one
Melina	PS	Saudi	3 weeks	No	1, 2, 3, 4, 6	One to one
Sophia	PS	Chinese	4 months	No	1, 2, 4	One to one
Jade	PS	Chinese	3 weeks to 4 months*	No	1, 3, 4, 5	One to one
Cyan	ELS	Chinese	7 months	Yes	3, 4, 5, 6	One to one
Violet	ELS	Taiwanese	4 -7 months**	Don't know	1, 2, 3, 4, 5, 6	One to one

* depending on whether they started their Pre-Sessional course in September or January

** depending on whether Violet had attended the International Summer School at ELTC in 2018

Distinguishing features of the February start participants: This group had the highest proportion of Pre-Sessional [PS] students. Despite having no experience of postgraduate study in the UK, these participants might be expected to know something about what would be required in their departments, for example in terms of critical thinking, from their previous studies at the ELTC.

Table 1b: Participant information for the May start course

May start course						
Name	**Program**	**Nationality**	**Previous time at Sheffield University**	**Attended Internation-al Summer School?**	**Workshops attended**	**Interview type**
Agnes	ELS	Chinese	7 – 10 months**	Don't know	1, 2, 3, 4, 5, 6	Group
Cyan	ELS	Chinese	10 months	Yes	1, 2, 3, 4, 5, 6	
Jean	ELS	Chinese	7 – 10 months**	Don't know	1, 2, 3, 5, 6	
Joy	ELS	Chinese	7 – 10 months**	Don't know	1, 2, 3, 5	
Helen	ELS	Taiwanese	7 – 10 months**	Don't know	2, 4	Group
Mary	ELS	Chinese	7 – 10 months**	Don't know	2, 4, 5	
Robin	ELS	Chinese	7 – 10 months**	Don't know	3, 4, 6	
Lohita	ELS	Indian	7 – 10 months**	Don't know	1, 2, 3, 4	One to one
Dandan	ELS	Chinese	7 – 10 months**	Don't know	2, 3, 4, 5, 6	One to one

** depending on whether they had attended the International Summer School at ELTC in 2018

Distinguishing features of the May start participants: As all these participants had been studying on their degree courses at Sheffield for seven months, they were probably the most familiar with norms and expectations relating to critical thinking in UK academia.

Table 1c: Participant information for the October start course

October start course						
Name	**Program**	**Nationality**	**Previous time at Sheffield University**	**Attended Internation-al Summer School?**	**Workshops attended**	**Interview type**
Abda	PS	Saudi	3 weeks	No	1, 2, 3, 4, 5, 6	Group
Hilary	ELS	Chinese	3 weeks	No	1, 2, 3, 4, 5	
Sam	PS	Chinese	3 weeks	No	1, 2, 3, 4, 5	
Yaling	ELS	Chinese	3 weeks	No	1, 2, 3, 4, 5, 6	
Olivia	ELS	Chinese	Up to 4 years*	Don't know	3, 4, 5, 6	One to one
Ayşegül	PS	Turkish	3 weeks	No	3, 4, 6	Group
Portia	ELS	Chinese	4 months	Yes	1, 2, 3, 6	
Rose	ELS	Chinese	3 weeks – 4 months**	Don't know	1, 2, 3, 4, 5, 6	
Max	EPM (another EAP course)	Chinese	4 months	Yes	3, 4, 5, 6	One to one

* Olivia may have done her undergraduate degree in the UK; see p. 99

** depending on whether Rose had attended the International Summer School at ELTC in 2019

Distinguishing features of the October start participants: The participants on this course had the least experience of postgraduate study or UK academia.

Unfortunately, I did not ask them about their previous experience of learning about critical thinking, including in their own countries. This might have been useful information for the analysis (but see p. 177, "Recommendations for further research").

I conducted the one-to-one interviews using a list of six open questions, which were:

1. Before starting the course, what did you think critical thinking meant? What did you think a good critical thinker was like, or did?
2. Have you changed your mind about this? If so, how and why?
3. What did you think of your own critical thinking before starting the course?
4. Do you think this course has changed how you feel about yourself as a critical thinker, or about your own critical thinking skills? If so, how and why?
5. What did you think or feel about climate change before starting the course? Has this changed since then, if so, how and why?
6. Is there anything else you would like to say about this course?

I asked participants to review the workshops before they were interviewed and told them what areas I would be covering. The May and October start cohorts received an email reminding them of their responses to the Pre-Course Task. I brought a print-out of these responses to the one-to-one interviews, and for the group interviews I incorporated the participants' anonymised responses to the Pre-Course Task into the prompt slides (see below). I used the print-outs and slides to remind the participants what they had said about critical thinking and climate change before the course to help them answer questions 1 to 5 above, particularly the questions about changes in their perceptions or attitudes. (Please see pp. 70 - 71 for my explanation of how I aided the February start participants, who did not complete a Pre-Course Task, to make these comparisons). I started the interview by recapping the content of the workshops that they had attended. As the students talked, I made some notes on paper, as well as recording the interview with a small device on the table. For the group interviews, I put the questions on presentation slides and then turned my back on the group or looked away so they would be encouraged to talk amongst themselves rather than to me, which they generally did. When they had exhausted one question, the students prompted me to move on to the next slide with a new question. Among these slides were their anonymised responses to the Pre-Course Task, for their reference. I video recorded the group interviews so that later I would be able to tell who had said what.

The interview questions were quite open, and I encouraged participants to answer them as fully as possible, sometimes prompting them or asking for clarification. This was not often necessary in the group interviews because the participants did this for each other. However, interviewees sometimes asked for further explanation of the questions. In particular, participants in all cohorts found it difficult to distinguish between the focus of Questions 1 and 2, that is, changes in their concept or definition of critical thinking; and the focus of Questions 3 and 4, where they were encouraged to reflect on the development of their own critical thinking, so I had to explain this in nearly every interview. I discuss possible reasons for this in the Discussion chapter (see pp. 162 - 163). However, not all the participants in the group interviews answered all the questions fully. For example, as can be seen in Table 3 on pp. 129-130 of the Findings and Data Analysis chapter, some of the nine participants did not mention their level of concern about climate change after the May or October start courses. Making sure that everybody answered all the questions would mean interrupting the conversation, and I did not want to disrupt the dynamics of the discussion by doing so.

Transcription

I started transcribing and analysing the interviews after the second course. Initially, I decided that time spent transcribing interviews in full would be better spent listening to them repeatedly to familiarise myself with them, as advised when using thematic coding and analysis (Boyatzis, 1998; Braun and Clarke, 2006; Wellington, 2015). However, I soon found that I had to transcribe chunks of speech almost verbatim to avoid imposing my own interpretation of the students' words too early in the process. In the end I developed a system combining word-for-word transcription with a limited amount of paraphrase, for example, for my own speeches, or for "housekeeping" exchanges like agreeing where to sit. I only paraphrased the students' speeches where I was quite sure I would lose none of their meaning (which was not very often).

As I explained in the section on "Epistemology" (pp. 46 - 48), I was not trying to read between the lines of what the participants were saying or how they said it, as psychologists such as Braun and Clarke (2006) might do in their analyses. When in the interviews I asked

the students questions relating closely to my research focus, I took their answers at face value. So, I thought that careful paraphrase for some parts of the interviews was acceptable. As Braun and Clarke (2006) maintain,

> thematic analysis, even constructionist thematic analysis, does not require the same level of detail in the transcript as conversation, discourse or even narrative analysis. As there is no one way to conduct thematic analysis, there is no one set of guidelines to follow when producing a transcript (p. 88).

They add that the transcript should retain the information required by the researcher and be "practically suited to the purpose of analysis" (p. 88).

Following this advice, I removed items from the transcriptions that were not relevant to my analysis, such as back-channelling and fillers like "um". Where one student interjected a word or two into another student's "long turn" in group interviews, I inserted this in brackets with the name, e.g. "[Jack: It depends]". Unclear sections in the transcripts were indicated with the word "unclear" in square brackets and italics, sometimes followed by what I thought the interviewee might have said and a question mark, e.g. "[*unclear* distinguish?]". Very occasionally, a word in square brackets was added because I thought that if the passage were taken out of context the interviewee's meaning might be misunderstood, e.g.:

> And after that you will feel, oh, I know some debate in this topic, or in the field, and you know some – you can actually feel some point is not right, it's not objective, you can feel it, and you can use some other scholar's opinion to debate, to argue [with] that.

I also placed non-verbal elements such as laughter or gestures in brackets, and italicised words on which participants had placed a particular emphasis, for example:

> Melina: I love to question the arguments. But I'm not a *very* good critical thinker.

The observational data

In addition to the interviews, I used four types of observational data as mentioned above. These were: observational notes on the workshops based on memory, video recordings, comments from observing teachers, and summaries of conversations with students after workshops. My techniques for recording my observations were as follows.

As soon as possible after each workshop, I annotated my lesson plan. These notes included: my assessment of the students' level of English and apparent familiarity with the critical thinking concepts presented in the workshops; comments on how the students reacted to the activities and materials, with suggestions for improvements (Cohen et al., 2011); reconstructions of my conversations with students after the workshops (Cohen et al., 2011; Kawulich, 2005); and reflections on both the workshops and these conversations (Kawulich, 2005). Three of my colleagues at ELTC observed at least one workshop each, and one non-ELTC teacher with extensive experience of teaching adults in Further Education observed most of the February start course; their observations provided useful feedback on my delivery of the workshops (see pp. 53 and 71). I also video recorded and watched again some of the lessons to help me remember what had happened, pick up incidents I had not noticed at the time, and evaluate my own teaching techniques, all of which are recommended by Cohen et al. (2011).

In the section on methodology above, I mentioned that I found observations useful for testing my hypotheses about the data. An example of this is my conjecture that students might find critical thinking difficult, or even painful, if they have to abandon a view of knowledge as a single truth handed down by an authority and learn to evaluate competing claims to the truth for themselves. This hypothesis was supported by a "critical event" (Cohen et al. 2011, p. 464) from a workshop where a student was asked to evaluate the sources behind three different answers to a question. The student wanted to know which answer was the "truth". I do not know whether my refusal to tell him was the reason this student subsequently dropped out, but he did appear to be quite uncomfortable. Another example is my speculation that Olivia was distressed by challenges to long held beliefs because she felt that her identity as a Chinese citizen was under attack, as described in the Discussion chapter (pp. 157-159). I compared her story (which was recorded in the interview transcripts) with a very similar story of confusion from Helen (which was recorded in the observation notes). Helen is not from mainland China, and so this suggested to me that their crises might be caused by the loss of epistemological certainty described above, rather than by threats to national identity.

3.3.2 Data analysis

As discussed in the section on my choice of methods (see pp. 53-57), I used thematic analysis for my interview data. There are several versions of thematic analysis, and although key terms recur, they are used in different ways in the literature. So to clarify: in this analysis, I will refer to participants' utterances from transcripts as "items", assigned to "categories", and I will call the whole process "coding".

Coding can be deductive, i.e. taken from existing theory or research, or inductive, i.e. seeming to emerge from the data, or a mixture of the two (Wellington, 2015), as in this research project. Although I was not consciously looking for particular concepts or topics, I had read extensively about the three models of critical thinking described in the Literature Review and about the factors that inform common attitudes to climate change. Unsurprisingly, some of the categories I created were influenced by this reading, such as "awareness of multiple perspectives" and "respect for others' views". Other categories seemed to emerge from the data, although in reality they arose from my own mind (Braun and Clarke, 2006; Brice, 2005). Examples of these are "critical thinking as a process", "culture", and all the categories relating to climate change.

Data analysis for the February start cohort

Initially, I analysed the data from the three courses separately. This allowed me to make comparisons between cohorts which differed somewhat, for example in the ratio of ELS (in-sessional) to Pre-Sessional students, or the length of time they had been studying in the UK; I thought these cohort differences might provide valuable insights at the analysis stage.

This is how I conducted the analysis for the February start course. First, I listened to each interview several times to familiarise myself with it (Wellington, 2015). As I did so, I expanded and amended my interview notes to create transcripts consisting of a mostly verbatim record with some paraphrase, as described above in "Transcription". When I was satisfied that these transcripts were sufficiently comprehensive and representative of the interview for my analysis (Braun and Clarke, 2006), I read through them and highlighted the parts that seemed relevant to the research questions (Wellington, 2015). Next, I created

some initial categories for these items and labelled them, for example “CT [Critical Thinking] AS ARGUMENT BUILDING”, or “CONCERN IN STUDENT ABOUT CC [Climate Change]”. Next, I gave a different font colour to each participant’s contributions to distinguish them, created a list of category labels for all the February interviews in a separate document (the “category list”), and put the colour-coded items in the appropriate categories. I also created pseudonyms for the participants.

As I worked, I amended the categories, mainly by splitting them into subcategories. For example, if an activity or skill was identified as a component of critical thinking before the course, it was preceded by “BC”, and if identified as such after the course, by “AC”; for example “BC: ARGUMENT BUILDING” or “AC: ARGUMENT BUILDING”. The same prefixes applied to attitudes to climate change before and after the course, for example “BC: CONCERN IN PARTICIPANT ABOUT CC”. For critical thinking factors, I used the prefix “IMPACT” to show that a participant felt that learning about this aspect of critical thinking had changed their own thinking in some way (see p. 96 for an explanation of how I measured “impact”). I added the mathematical symbols for “plus”, “minus” and “equals” to the categories relating to levels of concern or knowledge about climate change to indicate whether these were high or low, and whether they changed as a result of participating in the workshops. I also merged or dropped categories with only one or two items. Lastly, I tagged the items in the transcripts with the category labels using the comment function. I now had a list of category labels, with the relevant items below each, colour coded so I could see at a glance who had contributed which. This allowed me to form an impression of the prevalence of each category and to distinguish, for example, whether several interviewees had referred to a particular concept such as argument building once or twice each, or one person had alluded to it many times. Braun and Clarke (2006, p. 82) say that the “prevalence” of a theme may be measured by “the number of different speakers who articulated the theme, across the entire data set, or each individual occurrence of the theme across the entire data set”. I decided to use both of these measures, counting both the items in a category and the participants who “produced” these items, giving the latter more weight in my analysis. This meant that the data would not be skewed if, for example, one participant was particularly enthusiastic about an aspect of critical thinking or climate

change that none of the others was interested in. In the analysis I equate the prevalence of a category to "salience".

I now needed to be able to see patterns in the data. In a separate document, I put related subcategories with their items together, for example "BC: CONFIRMATION BIAS", "AC: CONFIRMATION BIAS" and "IMPACT: CONFIRMATION BIAS", so I could see a "story" emerging. I copied this document and stripped out the items, so I now had a second "reduced" version of the category list. Then I counted how many interviewees had referred to this category, which I recorded in non-italicised font, and how many incidents there were of each category across all six interviews, which I recorded in italicised font and in brackets. Examples are:

> BC: CONFIRMATION BIAS: 1 *(1)* [i.e. one person mentioned this once]
>
> AC: CONFIRMATION BIAS: 4 *(4)* [i.e. four people mentioned this a total of four times, or once each]
>
> IMPACT: CONFIRMATION BIAS: 2 *(3)* [i.e. two people mentioned this a total of three times]

This gave me a clearer idea of which critical thinking factors were identified by interviewees after the course but not before, where the greatest impacts of the course on students' thinking were, and how "popular" each category was. It also allowed me to see the changes in perceptions of climate change before and after the course. Then I wrote a summary of what I thought the data might show at this stage (initially about critical thinking only). This was the "story" for February, which was later combined with "stories" for the later courses as described below.

After I had "zoomed out" in this way to get an overall picture of the data related to critical thinking, I "zoomed in" again on the category list with the items to see if my initial "story" was still consistent with the data, or whether I had missed anything. Revisiting the students' original utterances as well as their labels allowed me to illuminate and add nuance and detail to the story. I also noted where I thought it was significant that the same people had referred to different categories or subcategories. For example, five students who said they lacked confidence in their critical thinking abilities before the course all reported a deeper

understanding of, or impacts on, their critical thinking afterwards. As I went, I continued to move items from one category to another or replicated them in more than one category. I added detail to the story and added "What does it mean?" where I thought I would have to interpret the pattern I had described later. Finally, I repeated the whole process to create a "story" about the data relating to climate change.

Data analysis for the May start cohort

The analysis of the data for the May start cohort followed much the same pattern as above, with two main differences. Firstly, I analysed the participants' completed Pre-Course Tasks along with the interview transcripts, so I could compare what they said about critical thinking and climate change before and after the course. Secondly, instead of creating all the categories from scratch, I started with the ones from the February start course and created more where necessary. Some of these categories were new, for example "RESPECT FOR OTHERS' VIEWS"; some were based on existing categories, such as "IMPACT: CT APPLIED TO STUDY", which was modelled on "IMPACT: CT APPLIED TO LIFE"; and others were retrieved after being deleted or merged in the previous cycle of analysis because they did not have many items, e.g. "DISCUSSION". (Such categories were then retrospectively reinstated). As before, I tagged each item in the transcripts with the appropriate label, but this time some items were placed in more than one category.

I created a list of category labels for the second data set as I had done for the first, colour-coded the font of the items from the transcripts to identify the participants and put the items under the relevant labels. Again, I created two category lists, with and without items, and used the latter to count how many times each category was mentioned and by how many people. This time I noted the names of the participants on the "reduced" list, to help clarify the patterns that I perceived to be emerging. As I worked, I subsumed some categories into others, e.g. "COLLECTION ACTION ON CC" was subsumed into "CC AS A COLLECTIVE PROBLEM". Other categories relating to climate change were re-worded, for example, LACK OF CONCERN IN OTHERS ABOUT CC became CONCERN IN OTHERS ABOUT CC+/-.

As previously, I then wrote a piece I called "What's the Story?" where I tried to make sense of the data. Again, I noted where there were changes in the students' concept of critical thinking, where they reported impacts on their perceptions of their own thinking, or where there were changes in their perceptions of climate change. I tried to analyse what was behind these changes (or lack of them). I also cross-checked with the February analysis to see if the patterns were similar, made notes on this and wrote speculative notes about any differences. Because there were more categories for the May course than the February one, I re-examined the February data to see if the new categories for May could be retrospectively applied, which they sometimes could, for example "SELF-AWARENESS" and "CT AS A PROCESS".

Data analysis for the October start cohort

The analysis of the October start data followed much the same process as for the May start course, including the use of data from the Pre-Course Tasks, and culminated in a "story" where I tried to make sense of the patterns I had seen in the data.

I began by using the categories from the first two analyses, and added more as I went, including categories that had previously been subsumed into others for the first course (for example, "PROBLEM SOLVING") or the second (for example, "DIFFICULTIES AND CHALLENGES") and which I now resurrected. I also checked to see if new October start categories could be applied to previous courses, so comparisons could be made. By the time I had finished my analyses of the data from all three cohorts, I had a list of 29 categories (if subcategories such as "BC: QUESTIONING", "AC: QUESTIONING" and "IMPACT: QUESTIONING" are counted as one category). 19 of these were about critical thinking, nine were about climate change and one category was about the workshops themselves.

I compared the October "story" to the ones from both May and February and noted where the findings were consistent or different. Again, I wrote speculative notes about what the significance might be of the patterns I had seen. At this point I went back to the notes I had written about the workshops and my conversations with students, to see if these could shed any further light on my interpretation of the data in the "stories".

Cross cohort analysis

After I had analysed each cohort separately, I looked for an overall pattern in all the findings together. Firstly, I re-read the three "stories" and my notes on them, looking back occasionally at the original items and at my observational notes to see if I could gain any insights to help me theorise about the data. This was my initial attempt at recombining and synthesizing data, which is "sometimes referred to as the method of constant comparison and contrast … this phase consists of searching for patterns, themes and regularities in the data or units of data; it also involves looking for contrasts, paradoxes and irregularities" (Wellington, 2015, p. 262).

This attempt was partly successful, but it was quite difficult to see the "big picture" by looking at the verbalised versions of the findings. So I drew up a table showing the numerical results for the categories for each cohort, and the totals for all 23 participants, like this extract from Table 2 (see p. 92.)

Extract from Table 2: Findings of the analysis for critical thinking

	February (out of 6 participants)	**May (out of 9 participants)**	**Oct (out of 9 participants)**	**Total (out of 23 participants)**
BC: ARGUMENT BUILDING	2 *(2)*	4 *(4)*	4 *(5)*	**10** ***(11)***
AC: ARGUMENT BUILDING	1 *(1)*	2 *(2)*	3 *(3)*	**6** ***(6)***
IMPACT: ARGUMENT BUILDING	1 *(1)*	4 *(6)*	1 *(1)*	**6** ***(8)***

This made it much easier to see patterns in the data and therefore to speculate about the reasons for them.

After I had done this for all the critical thinking categories, I repeated the process for the climate change ones. The pattern was much less clear than for critical thinking, and the figures in Table 3 (showing the findings of the analysis for climate change) did not always

add up; for example, the total number of participants in each column did not always equal 23. I also did not feel the tabulated findings gave the reader an overall sense of each cohort's perceptions of climate change, as suggested by the "stories". So I checked the category lists with items again, refined some categories (for example by creating "unsure or mixed" subcategories in addition to the plus and minus ones, indicated by a question mark) and reallocated items accordingly. Then I double checked that all the figures added up, which they now did. Next, I cross checked the numerical data in Tables 2 and 3 with all three "stories", to make sure that they were compatible. Finally, I returned to my post-workshop notes and summarised conversations for further insights, as in the third cycle of analysis.

The final stage was writing up my analysis in prose. This led me to re-examine the items in the categories yet again to pick up any details I might have missed in the patterns I had identified, and to aid my speculations about these patterns. For example, I realised when I re-read the items in the category "argument building" that only half of these also mentioned "evidence", which prompted me to consider what the students understood by building an argument (see the Discussion chapter, p. 151). I also noticed when writing up my analysis that the critical thinking categories can be divided into three groups, relating respectively to: skills or dispositions, factors that influence critical thinking, and the development or application of critical thinking. This grouping will be revisited in the next chapter, on pp. 95-96.

Further notes on the categories

The rules governing how items were placed in categories are described in Appendix 4. Below is further clarification of some aspects of my categorisation.

According to Cohen et al. (2011) and Braun and Clarke (2006), extracts of data may be coded for as many categories as are relevant. Several of my categories share items, especially the broader categories such as "self-awareness". For example, this item appeared was categorised as both "self-awareness" and "confirmation bias":

> Yaling: We want to trust, who we want to trust … We want to trust the thing that we want to trust … [All nod]… We trust the people who we believe, he or she is right. [General nodding]. So I trust my government, so whatever [laughs].

This item appeared in both "deeper understanding of critical thinking" and "workshops are useful or engaging":

> Hilary: Every courses give some different kind of guidance. It help you get more informant about critical thinking in your life.

The categories of "multiple perspectives", "framing" and "respect for others' views" may appear to be similar or even synonymous. However, although "multiple perspectives" and "framing" are closely related, they do not share any items. On the other hand, some items in the category "respect for others' views" also appear in "multiple perspectives". The reasons behind the distinctions between these categories is explained in more detail in Appendix 4.

I have amalgamated "questioning and "analysis" into one category because critical questioning can be seen as the first step in analysis. Interrogative pronouns and adverbs, such as *what*, *when*, *where*, *why* and *how*, can be used to analyse arguments (Cottrell, 2011) or reading texts (Metcalfe, 2006). Facione (1990) claims that analysis entails "detecting arguments", and uses two such question words in his example:

> For example, given a paragraph, determine *whether* a standard reading of that paragraph in the context of *how* and *why* it was published, would suggest that it presents a claim as well as a reason or reasons in support of that claim; given a passage from a newspaper editorial, determine *if* the author of that passage intended it as an expression of reasons for or against a given claim or opinion (p. 8) [my emphases].

The conjunctions "whether" and "if" in this quotation also respectively suggest questions beginning "Would a standard reading of that paragraph suggest …?" and "Did the author of that passage intend …?"

For my participants, the question "Is climate change really caused by human activity?" might lead to analysis of the causes of climate change, if they are studying a science. Asking "Can I always trust what my government says?" might be the first step for students in other disciplines, such as politics, sociology or journalism, in analysing the reasons why authorities might give the public inaccurate or misleading information. I also felt that non-scientists might not use the word "analysis", but nevertheless be engaged in analysis in the social sciences or humanities by means of questioning.

In placing items in the category "participant's knowledge about climate change", I have sometimes accepted at face value participants' suggestions that they understood something

about this issue in the absence of any details. For example, Ayşegül said in her Pre-Course Task that "there is a science history of climate", without specifying what exactly she had learned from this, but I gave her the benefit of the doubt. Where participants displayed specific knowledge that is consistent with the scientific consensus, such as that temperatures are rising or that polar ice is melting, I have also counted this as participant knowledge. As I have been campaigning on the issue for nearly 20 years, I have a fairly good knowledge of the issue, including common misconceptions about the causes and effects of climate change due to conflation with other environmental issues. An example of this is the idea that plastic waste is a direct cause of global warming (Berners-Lee, 2010), a belief implied by at least two of the participants, Abda and Lohita (see p. 141). So there have been occasions where I have made my own judgement about whether what the participants claim to know about climate change actually constitutes knowledge or ignorance.

3.4 Ethical considerations

The project received ethical approval from the University of Sheffield; the letter acknowledging this can be found in Appendix 5. Below is an account of what I did to secure this approval.

Informed consent

To ensure properly informed consent, I gave students a handout covering the purpose of my study, an overview of its stages, what participants would be expected to do, the advantages and disadvantages of participating, the complaints procedure, and how the data would be used. This was slightly adapted from course to course, for example by removing the focus group held in the first course from the information sheets for the later courses and adding the video recording of group interviews.

I advertised and ran an information session at least one week before each course which covered the same points as the information sheet, but in a simpler form; this session also allowed students to ask me questions directly. I sent the information sheet to students who could not come to this session, requested that they sign and return a consent form to

confirm that they had read it, and invited questions by email. I offered to meet in person individual students who were unable to come to the information session, but no-one accepted this offer.

The consent form covered the receipt of the information sheet, participants' unconditional right to withdraw, confidentiality and anonymity, the recording of workshops and interviews, and the use of data. Although the consent form for all three courses covered video and audio recordings of interviews as well as workshops, I failed to amend the information sheet for May, which said that interviews would be audio recorded only. The May information sheet also omitted the Pre-Course Task. So before starting the May group interviews, I asked participants to sign an extra form to consent to be video recorded. In addition, I gained written permission from all interviewees in the May start cohort to use the data from their Pre-Course Tasks. My ethical approval was amended to cover these extra consent forms. For the October start course, I added my intention to video the group interviews to the information sheet and amended the consent form to cover use of the Pre-Course Task data.

Data protection

Students were recruited according to the University of Sheffield's data protection rules. The only personal data collected from participants were their University email addresses, which expired when they left the University, and pseudonyms were used to protect their identities in the data. I transcribed the interviews myself, and only I and my doctoral supervisor had access to the data generated at any stage of the research. I stored all the data, whether video, audio or written, on a password-protected and encrypted laptop. Teachers who observed the workshops (for the reasons given on pp. 53 and 71) agreed not to discuss what the participants said or did with anyone else.

Classroom environment

The students were warned in the information sheet and session that they would be asked to examine their existing beliefs, and that these would also be open to question or challenge

from other students, which might prove uncomfortable. However, critical thinking includes being able to question one's own beliefs, defend them in a debate and be open to other points of view (Cottrell, 2011), so I explained that this should be no more distressing an experience in my workshops than it would be on their degree courses. I aimed to provide a safe and supportive environment where students knew that everybody's views would be treated with respect (although *not* a "safe space" in the sense that individuals would be protected from hearing any views that might distress them).

To this end, I focused on creating a friendly atmosphere among the students, and between the students and me. I chose topics, elicited ideas and opinions and scaffolded activities carefully so as to challenge the students, but to avoid giving offence or creating conflict that would destroy this atmosphere. For example, I steered well clear of the topic of Taiwanese independence, as I had Chinese students in every class. My reasoning was that if students' sense of identity was threatened by the inclusion of controversial and politicised topics, they would be less likely to listen calmly to other people's viewpoints. To reduce the power/knowledge imbalance, I admitted to my own possible biases and told them about my own struggles with culture and identity, and gave them space in small groups to discuss their own issues (or not, as they wished). In the event, students brought up quite controversial topics of their own accord. For example, two students in the October cohort from mainland China spoke of the "elephant in the room" when they went out to dinner (in London) with friends from Hong Kong, at a time when there were protests in Hong Kong against the government in Beijing. Two other students (one from each of the two latter courses) told me, unprompted, that the supportive class atmosphere allowed them to discuss potentially difficult subjects. As one said, "it's a very open-minded atmosphere … and we can talk about anything, anything in the lessons … and we don't reject any ... disagreed point … No anger, yeah".

In the next chapter I will discuss the findings of my analysis of the data generated by the methods described in this one.

4. Findings and Data Analysis

4.1 Introduction

In the Methodology chapter, I described how I generated and analysed my data for this study. In this chapter, I will explain how I organised and interpreted the findings in order to answer my research questions: in other words, to ascertain if, as a result of the workshops, students' concept of critical thinking had changed; if they noticed any changes in their own thinking; and if there were any differences in their attitudes to climate change. In the Discussion chapter, I will explore in more depth some of the major concepts and questions that emerged from the analysis in relation to the existing literature in this field.

I will discuss the findings relating to each research question in turn. Table 2 below summarises findings relevant to the first three research questions, about critical thinking (as opposed to climate change). The first figure in each pair refers to the number of participants who produced the items placed in a particular category, and the second figure, in italics and brackets, gives the number of items in that category overall. The table is followed by a more detailed explanation of the findings.

4.2 Critical thinking

Table 2: Findings of the analysis for critical thinking

Note: One participant, Cyan, attended both the February and May start courses. To avoid confusion, he has been counted separately as one of six participants in the former and one of nine in the latter (indicated by an asterisk) but counted only once in each figure in the "Total" column.

	February (out of 6 participants)	**May (out of 9 participants)**	**Oct (out of 9 participants)**	**Total (out of 23 participants)***
BC: QUESTIONING AND ANALYSING	5**(6)*	5**(6)*	5 *(9)*	**14 *(21)***
AC: QUESTIONING AND ANALYSING	3**(3)*	1 *(1)*	5 *(10)*	**9 *(14)***
IMPACT: QUESTIONING AND ANALYSING	2 *(2)*	3 *(9)*	2 *(2)*	***7 (13)***
BC: MULTIPLE PERSPECTIVES	2 *(3)*	4 *(5)*	6 *(8)*	**12 *(16)***
AC: MULTIPLE PERSPECTIVES IN CT	3 *(3)*	3 *(4)*	6 *(9)*	**12 *(16)***
IMPACT: MULTIPLE PERSPECTIVES	3 *(4)*	3 *(3)*	7 *(9)*	**13 *(16)***
BC: ARGUMENT BUILDING	2 *(2)*	4 *(4)*	4 *(5)*	**10 *(11)***
AC: ARGUMENT BUILDING	1 *(1)*	2 *(2)*	3 *(3)*	**6 *(6)***
IMPACT: ARGUMENT BUILDING	1 *(1)*	4 *(6)*	1 *(1)*	**6 *(8)***
BC: CONFIRMATION BIAS	1 *(1)*	1 *(1)*	1 *(1)*	**3 *(3)***

AC: CONFIRMATION BIAS	4 *(4)*	5 *(6)*	8 *(10)*	**17 *(20)***
IMPACT: CONFIRMATION BIAS	2 *(3)*	6 *(8)*	5 *(7)*	**13 *(18)***
BC: USE OF EVIDENCE AND SOURCES	1 *(1)*	2 *(2)*	1 *(2)*	**4 *(5)***
AC: USE OF EVIDENCE AND SOURCES	3 *(3)*	6 *(9)*	4 *(6)*	**13 *(18)***
IMPACT: USE OF EVIDENCE AND SOURCES	2 *(2)*	3 *(5)*	5 *(5)*	**10 *(12)***
BC: FRAMING	0	0	0	**0**
AC: FRAMING	5 *(11)*	0	7 *(12)*	**12 *(23)***
IMPACT: FRAMING	3 *(4)*	1 *(3)*	5 *(10)*	**9 *(17)***
BC: INDEPENDENCE AND INITIATIVE	0	2**(3)*	2 *(3)*	**4 *(6)***
AC: INDEPENDENCE AND INITIATIVE	2**(2)*	5 *(9)*	5 *(7)*	**12 *(18)***
IMPACT: INDEPENDENCE AND INITIATIVE	1 *(2)*	3 *(9)*	2 *(6)*	**6 *(17)***
BC: CULTURE	0	0	4 *(5)*	**4 *(5)***
AC: CULTURE	3**(3)*	2 *(2)*	5 *(8)*	**10 *(13)***
IMPACT: CULTURE	2**(3)*	2 *(3)*	5 *(7)*	**9 *(13)***

DEEPER UNDERSTANDING OF CT	5* *(14)*	9**(16)*	8 *(22)*	**21 *(52)***
WORKSHOPS ARE USEFUL OR ENGAGING	3 *(7)*	4 *(10)*	8 *(11)*	**15 *(28)***
DIFFICULTIES AND CHALLENGES	3 *(5)*	6 *(9)*	4 *(6)*	**13 *(20)***
BC: RESPECT FOR OTHERS' VIEWS	0	0	0	**0**
AC: RESPECT FOR OTHERS' VIEWS	2 *(2)*	2**(2)*	3*(3)*	**7 *(7)***
IMPACT: RESPECT FOR OTHERS' VIEWS	2 *(2)*	3 *(7)*	7 *(15)*	**12 *(24)***
BC: SELF-AWARENESS	0	0	0	**0/24**
AC: SELF-AWARENESS	0	0	5 *(12)*	**5 *(12)***
IMPACT: SELF-AWARENESS	2 *(2)*	6 *(11)*	3 *(11)*	**11 *(24)***
CT AS A PROCESS	5**(6)*	4**(14)*	3 *(5)*	**11 *(25)***
BC: CT APPLIED TO STUDY	3 *(3)*	4 *(6)*	2 *(3)*	**9 *(12)***
AC: CT APPLIED TO STUDY	3 *(3)*	2 *(3)*	0	**5 *(6)***
IMPACT: CT APPLIED TO STUDY	0	2 *(4)*	2 *(3)*	**4 *(7)***
BC: CT APPLIED TO LIFE	0	0	0	**0**
AC: CT APPLIED TO LIFE	4 *(6)*	1 *(2)*	2 *(3)*	**7 *(11)***

IMPACT: CT APPLIED TO LIFE	0	0	3 *(4)*	**3 *(4)***
BC: CT APPLIED TO WORK	0	0	0	**0**
AC: CT APPLIED TO WORK	0	2 *(3)*	1 *(1)*	**3 *(4)***
IMPACT: CT APPLIED TO WORK	1 *(3)*	0	0	**1 *(3)***
BC: NEUTRALITY OR OBJECTIVITY	0	1 *(1)*	0	**1 *(1)***
AC: NEUTRALITY OR OBJECTIVITY	0	1 *(1)*	5 *(9)*	**6 *(10)***
IMPACT: NEUTRALITY OR OBJECTIVITY	0	3 *(5)*	4 *(8)*	***7 (13)***
PROBLEM SOLVING	2**(4)*	1**(1)*	3 *(3)*	**5 *(8)***
LOGIC	0	0	4 *(9)*	***4 (9)***

For easy reference, the topics on the table are arranged in the same order that they are discussed below. I will consider the findings relating to critical thinking first, and then those relating to climate change.

For the purposes of this analysis, the critical thinking categories can be divided into three groups. The first group are those categories that can be seen as skills or dispositions of critical thinking. These are: “argument building”, “questioning and analysing”, “use of evidence and sources”, “logic”, “multiple perspectives”, “independence and initiative”, “respect for others’ views”, “neutrality or objectivity” and “self-awareness”. The second group are factors that may influence critical thinking, and which students arguably should be aware of in order to avoid pitfalls (Battersby and Bailin, 2013; Correia, 2016; Kahneman, 2011; Kenyon, 2014; Kuhn, 1999; Toplak et al., 2013). These are “confirmation bias”,

"framing" and "culture". The third group of categories relate to the participant's experience of developing critical thinking, including in my workshops, and of applying it. These are: "deeper understanding of CT", "workshops are useful or engaging", "CT [critical thinking] as a process", "difficulties and challenges", "CT applied to study", "CT applied to life" and "CT applied to work". For clarification of these categories, see Appendix 4.

As explained in the Methodology chapter, most categories can be further divided into subcategories preceded by "BC [Before the Course]", to allow me to answer the first research question; "AC [After the Course]", for the second research question; and "IMPACT" subcategories, for the third research question. For the first group of categories (skills or dispositions) above, I have put into the "IMPACT" subcategory items where participants said that as a result of the course they have noticed a quality, such as "independence and initiative", or activity, such as "argument building", in their *own* thinking (as opposed to identifying it as a component of critical thinking *in general*, in which case it is allocated to an "AC" subcategory). I have also done this for the second group of factors that might influence critical thinking, such as "framing", on the assumption that if participants have noticed this factor in their own thinking, they are more likely to try to avoid any bias it might lead to (Battersby and Bailin, 2013; Kahneman, 2011), although I acknowledge that they may not actually do so (Correia, 2016; Kenyon, 2014; Kuhn, 1999). The categories in the third group (experience and application of critical thinking), such as "CT [Critical Thinking) as a process", have not been subdivided into "BC", "AC" or "IMPACT".

I use quotations from the interview transcripts to illustrate my points in my discussion of the findings. My participants do not speak English as a first language; I have not corrected errors where I think the meaning is clear, but I have not used "[sic]" to show that these are their original words, to avoid distracting the reader. My participants, like many English language students in my experience, tend to use present tenses where "native" speakers would use past tenses. For example, in the section "Argument building" below, I give the following quotation from Dandan: "Before the course, I only picks up on others' opinion and paraphrase in my words and add some my own thinking, my own judgment". In such cases it should be clear from the context that the student is referring to past experiences, practices or perceptions.

4.2.1 Research Question 1: What do EAP students understand by "critical thinking"?

This section attempts to answer my first research question by examining the categories relating to critical thinking that were most salient for participants before they took the course; that is, categories representing topics which were mentioned at interview by the highest numbers of participants (in the first place) and the most frequently (in the second place). I will also discuss how salient these were after the course, and what impact, if any, the course had on the participants in these areas. (See the Methodology chapter, pp. 81 – 82, for further discussion of how I measured "salience").

In brief, before the course participants said that "critical thinking" meant questioning and analysing, looking at issues from multiple perspectives, and building arguments. In the Discussion chapter, I will return to why participants might have considered these three factors particularly important to critical thinking before the course.

Questioning and analysing

Questioning or analysing was described as an element of critical thinking by 14 out of the 23 participants, 21 times in total, so it was the most "popular" factor for participants before the course. However, some participants were not sure *how* to go about questioning or analysing what they read or heard. Hamra admitted that "I don't know how to question the information". Dandan seemed to lack the cognitive tools to carry out her analysis: "I remember once … you ask a question, and when you ask 'why', we don't know why. We just, you know, emotional and descriptive, and for me I don't know the true reason". For Hilary, these missing tools seemed to be conceptual: "Before I just … try to think some method to question some question, but I don't know some theory". Some participants seem to gain confidence as well as useful strategies in this area of critical thinking, which will be discussed in more detail in the Discussion chapter.

Over a third (or nine) of the participants referred to questioning and analysing as important to critical thinking after the course, and over a quarter (seven) said the course had had an impact on their own thinking in this area. This is perhaps unsurprising as all the workshops focused on questioning or analysing to some extent. Workshop 1 required students to question their sources; Workshop 2 to question their own or others' motives in selecting

evidence; Workshop 3 to analyse how issues are framed; Workshop 4 to analyse how world-views are shaped by cultural or social constraints; Workshop 5 to analyse the factors that influence the assessment of probability and risk, and Workshop 6 to analyse texts in the light of what they had learned in the previous five workshops.

Five out of six participants in the February start cohort (not Sophia) thought that questioning or analysing was important to critical thinking before the course, making it the most prominent factor. For example, Cyan said, "I think critical thinking is for problem or for issue, to know and to explore what it is, how does it work, and why it happened", and Hamra thought that critical thinking was, "when you try to analyse the information you get" or when "[you] try usually to question what you … read". Melina and Jade seemed to equate critical thinking with extreme scepticism:

> When I read an article, I will just criticize everything in this article. I wouldn't accept it as what it is. I will question it, like every part of it. [A critical thinker] question everything … and sometimes maybe they seems like they doesn't accept anything (Melina).
>
> If someone says it's right, I think maybe it's wrong (Jade)

The place of scepticism in critical thinking will be revisited in the Discussion chapter.

Three participants, Cyan, Melina and Jade, identified questioning or analysing as elements of critical thinking after the course, and Jade and Sophia said that they were more likely to question what they read as a result of the workshops. Sophia said, "after the class I can ask me, are you convinced? What's the evidence?" Jade said that she was now more aware of how news is filtered by the media: "they miss the detail, or the other things ... I think [the course] let me much more focus on the other side we didn't talk about or to justify media or the reports".

Five participants on the May start course, Cyan, Lohita, Agnes, Helen and Dandan, said that they considered questioning or analysing to be elements of critical thinking before they attended the workshops. For example, Agnes said that "when we read an article, we should analyse it critically instead of just accepting the author's idea automatically". Helen and Dandan, like Jade and Melina, seemed to think that critical thinking meant being sceptical in the sense of being prepared to doubt or question any viewpoint: Helen claimed that "critical thinking encourages us to challenge the perspective of mainstream while we should keep suspicious of everything", and Dandan said that "[f]rom my perspective, critical

thinking may be critical about everything". However, only Joy specifically identified questioning or analysing as a component of critical thinking after the course. At interview, after being reminded of what they had said in the Pre-Course Task, the May start participants were asked only how their concept of critical thinking had changed, so some participants may not have mentioned this factor because it was still important for them. Nevertheless, in this cohort, three interviewees reported that they were better able to ask critical questions and analyse arguments as a direct result of attending the workshops, and it was mentioned at interview more often than in the Pre-Course Task, nine times, albeit six times by Dandan. Dandan reported that she was more aware of the effect of her own emotion, emotional language and stereotyping on her analytical thinking. Lohita claimed that she had acquired the power to criticise articles, and Joy said that she was more aware both of the need to criticise herself, and of her own bias.

Five of the October start participants, Hilary, Yaling, Portia, Ayşegül and Olivia, said nine times that they thought questioning or analysing was a factor in critical thinking before the course. Hilary (like Helen, Dandan, Jade and Melina) thought that critical thinking was being "sceptical". Three participants also suggested that critical thinking meant being certain of the answers. Portia thought that "critical thinking is let me know the answers when we meet the questions, and … know what is right and what is wrong". Ayşegül said that it is "giving answer of what, why". Olivia explained that when she had encountered information about China during her undergraduate studies in the UK that contradicted what she had been told growing up, she had equated the resulting confusion and questioning with a *lack* of critical thinking. This is somewhat at odds with the concept of "questioning" in the sense of keeping an open and enquiring mind. In many academic disciplines, such as engineering (Claris and Riley, 2012), business studies (Reid and Anderson, 2012) and nursing (Gupta and Ushur, 2012) a tolerance of ambiguity is considered important to critical thinking. It is possible that some participants, such as Portia, Ayşegül and Olivia, started the course with a view of education that values certainty and adherence to a single truth; this possibility will be further explored in the Discussion chapter.

Five of the above October start participants, Hilary, Portia, Olivia, Rose and Max, also said that questioning or analysing was a component of critical thinking after the course. For example, Hilary said that "I think now I have almost the same on the essential points in that,

you should criticise, or you should question some points in our life". Olivia said that she now understood that "a good critical thinker is someone who doesn't just passively take what's been told, but actively analyses the information". Two of these participants suggested that the course had helped them develop this skill. Max said that it encouraged him to consider the causes and solutions of problems like climate change more carefully. Olivia said that "bearing these human nature/factors [which I learned about on the course] in mind helps me to be open-minded to ideas that go against my instincts and give these ideas a thorough consideration and analyse [analysis]".

Multiple perspectives

Seeing issues from multiple perspectives was the second most "popular" factor for participants before the course. It was mentioned by over half the participants (12 out of 23), a total of 16 times. It was equally salient after the course, again with 12 participants mentioning it 16 times. In addition, over half the participants (13) said the course made an impact in this area. This is perhaps because Workshops 1 to 4 all focused to some extent on multiple perspectives.

Two of the participants from the February start cohort considered seeing issues from multiple perspectives as an important element of critical thinking before the course. Sophia thought it was about seeing different viewpoints, and Jade thought that "a good critical thinker might think all the things, like the negative, opposite and even in the middle". Sophia, Hamra and Melina thought that this was a component of critical thinking after the course, and they also thought that it had helped them see issues from different perspectives. For example, Melina said that "it makes me think about … more point-of-views, so I don't just criticise the information from my point-of-view", and Hamra thought that trying to "think … the opposite way" would help her to write her essays. Sophia said she was better at understanding other people's "standing point". It is unclear why a relatively small number of participants in the February start cohort said they thought this was a factor before the course compared to the other two cohorts, but as the number of participants is small, this may be simply due to chance.

For participants from the May start cohort, having multiple perspectives was also considered to be an important component of critical thinking before the course, with four participants, Jean, Joy, Agnes and Mary, mentioning it five times. In fact, Joy, Agnes and Mary spoke of *two* perspectives rather than *many*. Joy and Agnes talked about the positive and negative sides to an issue and Mary said critical thinking was looking at "both sides". Dandan, Robin and Helen thought multiple perspectives were important to critical thinking after the course, but they all talked in terms of many points of view rather than just two. For instance, Dandan told the fable of blind people touching an elephant, each forming a different view of what an elephant is: two big ears, one long nose, legs like pillars, and so on. Not all the participants who considered this factor to be a component of critical thinking before the course mentioned it afterwards, but as mentioned above (p. 99), at interview the May start participants were reminded what they had said in the Pre-Course Task and then asked only what had *changed* in their definition of critical thinking. Three participants, Lohita, Mary and Dandan, also said at interview that the workshops helped them to see issues from multiple (not just binary) perspectives. For example, Lohita now understood that when doing research, instead of just reading articles that interested her, "I have to search all over a broad spectrum".

For participants in the October start cohort, as in the other two, seeing issues from multiple perspectives was considered to be important both before and after the workshops. Six of the participants said they thought this was a part of critical thinking before the course, Abda, Yaling, Portia, Rose, Olivia and Max. They described it as thinking in "different way/s" (Abda and Yaling) or from "different angles" (Rose) or telling more than "one story" (Olivia). All the participants mentioned it after the course, sometimes describing it as being "open minded" (Sam and Yaling). However, Olivia suggested that she felt uncomfortable with this ability because she wanted to be sure of what to believe: "That's what bothers me. I can understand the both sides, even the third party, or the fourth party… So, I don't have a conclusion!" As mentioned above, this tension between wishing for certainty and accepting ambiguity will be discussed in the next chapter. All but two of the participants (Max and Yaling) said that the course had made an impact on their thinking in this area. For example, Portia said, "I learn how to understand other people's [ideas], and why they think that way". Hamza said that listening to other people's reasons for their opinions could even change

one's own. I will explore the way that the participants' understanding of seeing issues from multiple perspectives appears to have been enriched in the Discussion chapter.

Argument building

10 participants alluded to argument building as an element of critical thinking before they took the workshops, a total of 11 times, making this the third most salient category. It was less salient after the course, with six participants mentioning it a total of seven times, and six saying, eight times in total, that the course had had an impact on their thinking. Workshops 1 and 2 in particular focused on the use of evidence and sources to form and support one's arguments.

Argument building, including having one's own opinion and using evidence to support it, was considered to be a factor in critical thinking before the course by only two participants from the February start cohort. Violet said that critical thinking was being "able to have your own opinion, argument". Jade, as we have seen, was inclined to contradict anyone who thought they were "right" but recognised the need to "find something to support" her own arguments. She said that building arguments was an important factor after the course, again maintaining the need for "evidence" to support them. Jade also reported an impact; while her ideas about what critical thinking was had only "changed a little", she now realised the need to use a wider range of sources of evidence to support her arguments. The role that "evidence and sources" play in students' understanding of argument building will be further discussed below, and in the Discussion chapter.

For participants from the May start cohort, argument building was considered to be a component of critical thinking both before and after the course. Dandan, Jean, Agnes and Joy considered it to be important to critical thinking before taking the workshops. Joy, for example, said that she and her fellow students found it "difficult to use reference and evidence to support our point, because … in China … we are not thinking it is so important to use the reference". (I will return to the possible differences in educational culture between the UK and the participants' home countries in the Discussion chapter). Two participants mentioned this factor after the course; Dandan simply repeated that she had not changed her mind, and Helen said that critical thinking meant being able to defend your

argument as well as supporting it with "literature". As mentioned above, the participants were asked only how their definition of critical thinking had changed after the course, which may be why the other participants did not mention this factor again. However, four May start participants, Lohita, Dandan, Mary and Robin, said they now had a better understanding of why or how one should build a strong argument. For example, Lohita said that "I understood … how you can explain your point to the other person". Mary suggested that her argument building was now more systematic: "[b]efore the course, I only picks up on others' opinion and paraphrase in my words and add some my own thinking, my own judgment".

The course had a noticeably greater impact in this area on the May start cohort, i.e. on four out of nine participants, than the other two cohorts, in each of which only one participant reported an impact. The samples from all three cohorts are small, making it dangerous to generalise about the differences between them. However, all the participants in the May start cohort were in-sessional EAP students who were already studying in their departments. So it is possible that they had had more opportunity than Pre-Sessional students to apply what they had learned in the workshops (for example about the use of reliable sources, the avoidance of confirmation bias, or framing) to their academic activities. I will discuss further where my approach to developing critical thinking might fit best into the student "journey" in the Discussion chapter.

Argument building was described as a component of critical thinking both before and after the course by some of the October start participants, but it was less salient afterwards. Four participants mentioned it before: Olivia, Rose, Sam and Max. Two expressed doubt in their abilities in this area; Olivia thought she was "not good at persuasion" and Max said, "I don't know how to explain my opinion". Ayşegül, Rose and Olivia mentioned argument building after the course. Only Ayşegül suggested an impact on her own thinking in this area, saying that she now had her own ideas and knew how to express them.

4.2.2 Research Question 2: Does exploring psychological and sociological factors which influence human thinking in workshops affect students' perceptions of what constitutes critical thinking? If so, how?

In this section I try to answer my second research question by examining the categories that were most salient at interview after the participants had taken the course, using the technique described above of counting how many people referred to it and how often. I will also discuss any impact the workshops had in these areas.

In short, after the course, participants still identified seeing issues from multiple perspectives as an important part of critical thinking, but added: avoidance of confirmation bias, use of evidence and sources, awareness of framing, independence and initiative, and awareness of the influence of culture on thinking. I will explore further how the workshops may have influenced the participants' concept of critical thinking in the Discussion chapter.

Confirmation bias

Awareness of confirmation bias was identified as a component of critical thinking after the course by the highest number of participants, 17, a total of 20 times. As with the other five "top" post-course factors, there was a significant increase in salience overall compared to before the course, when only three participants mentioned confirmation bias (albeit not using this exact term; see Appendix 4 for how items were placed in this category). Over half the participants, or 13, said that the course had had an impact on their own thinking in this area, a total of 18 times. Workshop 2 specifically explored the phenomenon of confirmation bias.

From the February start cohort, only Cyan did not mention confirmation bias at any point. Before the course, Violet said that "those people who support climate change, anything happened they can just say, 'oh yeah, that's climate change'", suggesting confirmation bias. After the course, Violet and three other participants, Hamra, Melina and Sophia, thought an awareness of this bias was part of critical thinking. For example, Melina was now aware that "[we] look to the evidence that we want to match our beliefs" and Sophia thought that "maybe people will do this unconsciously". All four used and defined the term "confirmation bias". Two participants, Hamra and Violet, found the course had made them more aware of confirmation bias in their own thinking, although they did not specify an intention to avoid it in future.

In May, confirmation bias was mentioned obliquely by only one participant in the Pre-Course Task, Mary, who said she did not use to be a good critical thinker because she had only looked for literature that supported her own views. However, five people said they were newly aware of the relevance of confirmation bias to critical thinking after the course: Mary, Dandan, Jean, Joy and Helen. Dandan and Jean both talked about "cherry-picking" evidence. Joy said that she had in fact known about confirmation bias from her regular studies, but previously she "didn't think there is a relationship between it and critical thinking". Helen explained how an understanding of confirmation bias could be applied to study: "everybody has their different opinions, but if they only collect the literature review supporting to their belief, then it's still confirmation bias".

Six participants from the May start cohort, Lohita, Dandan, Agnes, Jean, Mary and Helen, said the course had made them more aware of confirmation bias in their own thinking. For instance, Agnes thought, "cherry-picking, it happens all the time, but we didn't realise", and admitted she had probably been doing this in her essays. However, four participants suggested that they intended to try to avoid confirmation bias in future. For example, Helen said:

> now I know that I have another way … if I support something, some perspective, I need to find other perspective against it, then if I can argue, and make them feel not persuasive, then I think my perspective probably right. But if some of them against one make sense, then I will admit, yes, probably can choose another perspective. But before, I don't want to accept choosing another perspective.

From the October start cohort, only Olivia indicated obliquely that she considered confirmation bias to be important to critical thinking before the course. Interestingly, she said that she knew that the evidence presented by classmates (not in my workshops) who disagreed with her stances on Tibet, Taiwan and Hong Kong was "wrong in some way, but I don't know how to explain it to them", suggesting that perhaps she herself did not want to consider evidence that did not support her views. This might have been because it contradicted the story about China that she had grown up with, as discussed in the section above on "questioning and analysing".

Eight of the nine participants from the October start cohort (not Ayşegül) said that awareness of confirmation bias was an element of critical thinking after the course. Olivia thought critics of China were guilty of confirmation bias: "[i]f you want to believe China is

bad, you won't listen to all these other press said China is doing a good thing". Five of these participants suggested that they were newly aware of confirmation bias in themselves. Yaling, for instance, said that "we always pick the cherry we like" and that "we trust the thing we want to trust". Abda said that Workshop 2 (on confirmation bias) was the one "that influenced me". Three participants indicated that they would try to avoid confirmation bias in their own thinking in future. Portia said she had benefitted from the homework task for Workshop 2, where students were asked to pick one of their own beliefs and actively seek contradictory evidence. Max said that, when writing articles, he should resist choosing evidence that supported his personal beliefs. Sam said he would try to "disprove" his own opinion. Interestingly, Max accused the BBC and social media of confirmation bias over reports of civil unrest in Hong Kong in late 2019: "we can just see … that the policeman arrest the protesters, but we can't see any of the [images] that the protesters, they attack the police, and they destroy the public facilities". The BBC did in fact report attacks on the police and damage to property by protesters at the time (2019b), which raises the question of whether Max, like Olivia, may himself have been influenced by confirmation bias. In both cases, the participants may have felt uncomfortable with criticism of their home country and wished to defend it. The possible tensions between some Chinese students' sense of national identity and Western concepts of critical thinking are discussed in the next chapter.

The findings for the May and October start cohorts are similar, but both show a greater impact than for the February start cohort. As I have argued previously, the sample sizes are too small to attribute this to differences between the cohorts. However, it is possible that the participants from the February start cohort, who are mostly from the Pre-Sessional course, are still learning how to use evidence to support the opinions they already have and are not quite ready to consider the dangers of *only* considering this kind of evidence. The place of my approach to critical thinking in the student journey is discussed in the next chapter.

Use of evidence and sources

Use of evidence and sources was the second most "popular" critical thinking factor after the course. Although only four of the 23 participants said that they considered it to be important to critical thinking before the course, over half (13) mentioned it afterwards, a total of 18 times. 10 participants also said that the workshops had had an impact in this area. Workshops 1 and 2 both looked closely at the use of evidence and sources, and Workshops 5 and 6 revisited this area to some extent**.**

Although 20 participants overall mentioned evidence and sources in relation to critical thinking, a closer analysis of the data shows that eight of them did not refer to the credibility of their evidence or sources. However, six participants indicated that they were at least aware that their evidence should come from academic sources, and a further six that they should actively compare and evaluate sources for reliability.

In February, one person, Jade, said that she thought that supporting her arguments with evidence was an important part of critical thinking before the course. Three people, Hamra, Sophia and Jade, said this after the course. For example, Jade said, "when I finished the class I find there are many resource, some is from the scientific organisation … to choose to support the own opinion". Sophia and Jade said the course made them more likely to look for evidence in support of their own or others' arguments. Sophia said that the workshops had influenced her critical reading: "after the class I can ask me, are you convinced? What's the evidence?" She also said that although she had heard about climate change in the news, "I think I need more statistics or data to convince myself, such as how to evaluate this news, during a long period".

Similarly, in May, only two participants, Dandan and Helen, considered evidence or sources as important to critical thinking before the course, but six mentioned this factor in the interviews: Lohita, Dandan, Mary, Joy, Helen and Robin. For example, Helen said, "we need to criticise based on evidence", Mary believed that "us[ing] reference to support our ideas is also a kind of critical thinking", and Dandan had learned that "reliability is more important, like from where you have gathered that sources". Three participants, Dandan, Robin and Helen, said the course made them more likely to look for evidence in support of their own or others' arguments. For example, Dandan admitted that "some emotional words will

infectious me a lot before, also now, so I think from now maybe I could see more statistic data evidence and choose to examine the truth". Helen thought "we still need a lot of evidence to prove the climate change's cause". The observation that my workshops reduced some participants' certainty about climate change will be discussed in the section on Research Question 4, and in the next chapter.

Only Olivia from the October start cohort indicated her awareness of the relevance of evidence to critical thinking before the course. The role of evidence and sources in critical thinking became more salient for this cohort after the workshops. Four participants, Abda, Ayşegül, Dandan and Olivia, said that the course made them more aware of the importance of sound evidence and sources. Abda said "we have to accept the facts, even if against our belief", Ayşegül and Dandan talked about the importance of checking sources, and Olivia of having "knowledge to support my belief". Five participants reported a possible impact on their own thinking in this area, Abda, Ayşegül, Olivia, Max and Rose. Abda, Ayşegül and Olivia said they were now more likely to look for evidence in support of their own or others' arguments. Ayşegül claimed that "with this course I keep my mind to ask, when I read something, OK, it's talking about, writing about something, but where is the evidence?" Similarly, Abda said that after the workshops "if somebody … [gives me] some information, so I go to my phone and look it up, and find the source, is it right or not … it's supported by evidence or not". Max and Rose said they were now more careful to check the reliability of sources, although without specifying how.

Exactly half of the 26 items across the cohorts that are categorised as relating to "argument building" also refer to evidence. Similarly, out of the 11 items in the "BC: ARGUMENT BUILDING" subcategory, five also refer to evidence. As indicated above, not all the participants specified the type or quality of evidence needed for argument building. Four people who mentioned evidence said nothing about this, although five referred to the source (e.g. Jade's "some report"), the quality (e.g. Dandan's "detailed evidence") or the purpose (e.g. Agnes said "we need to provide evidence to support our opinions and make an academic argument"). Jade claimed that as a result of the workshops she was more likely to seek more credible evidence "from the scientific organisation" or academic journals as opposed to potentially less reliable evidence "just from the news".

In general, more participants identify argument building as part of critical thinking before the course than identify the use of evidence and sources, particularly in the October cohort, but also in the other two. This is noteworthy because the use of evidence and sources is generally seen as integral to building an argument in academic writing and speaking (Cottrell, 2011). The significance of this apparent disparity will be discussed in more detail in the Discussion chapter.

Framing

A definition of framing is given in the Literature Review (p. 28). Awareness of framing was the joint third most prominent category after the course in terms of numbers of participants who mentioned it (along with "multiple perspectives" and "independence and initiative"). It was identified as a component of critical thinking by 12 participants, a total of 23 times, and nine participants reported an impact in this area a total of 17 times. However, nobody said they regarded it as relevant to critical thinking before the course. The relationship between framing and the categories of "multiple perspectives", "self-awareness" and "respect for others' views" will be revisited in the Discussion chapter. Workshop 3 was devoted to the effects of framing on critical thinking.

After the February start course, all but one of the participants, Cyan, indicated that they were more aware of framing. For example, Hamra said that "we look out [of] the frame" and "no-one look to the big picture". Jade was surprised to learn that framing was such a powerful influence on our perceptions, and now thought that it was unwise to "judge from a small part to the whole thing". She also found it interesting that surveillance could be framed as a protection from danger, as in China, or as a threat to privacy, as it is sometimes seen in the UK. Three participants from this cohort said that learning about framing had already had an impact on their own thinking. Hamra said that now "I usually try to look at the bigger picture", Sophie said that "I can use it in my future work" in the attempt to understand other people's points of view, and Violet said that she would try to avoid assuming that other people would frame issues in the same way she would.

Framing was not a very significant factor for participants from the May start cohort, however. Only one of the May interviewees, Dandan, mentioned framing after the course,

but she said the workshops had had an impact in that she was now aware of what influenced her own framing: "that is depend on my value … and my life experience … and the people around me". The number of May start participants who mention this factor might be low because several months of postgraduate study had so normalised the practice of framing issues in different ways that they were no longer aware that they were doing so, nor consciously associated this practice with critical thinking. However, as the participant samples are small, this difference between the May start cohort and the other two may simply be due to chance.

In October, seven out of the nine participants (not Max or Portia) said that they now understood the relevance of framing to critical thinking. For example, Sam said that whereas he used to think that critical thinking meant "thinking in a logical way", he now thought it was "more about avoid … the influence by your instinct, or something like that, like framing". Olivia said that this concept "help me understand that people from different backgrounds would think diversely" and that it affects "the way … you approach the solution, the question". Five participants said they intended to try to apply framing to their own studies or real-world issues. Olivia thought it would be helpful for exploring different aspects of an essay question. Max said an awareness of framing might help avoid "mistakes about the cultural bias". Yaling believed that climate change could be solved with a new approach: "if we can develop some technology, to – like, we have to think outside the frame, right?"

The new awareness of framing displayed by participants from all cohorts suggests one way in which their understanding of critical thinking might have become more complex. There is also a possible shift from a "skills" to a "dispositions" view of critical thinking in Sam's addition of the idea of "avoid[ing] … the influence from your instinct" to his original perception of critical thinking as "thinking in a logical way". These two potential effects on students' perceptions of critical thinking will be revisited in the Discussion chapter.

Independence and initiative

Being independent and able to take the initiative was the joint third most prominent category in terms of numbers of participants who mentioned it at interview (together with

"multiple perspectives" and "framing"), with 12 participants mentioning this a total of 18 times. This topic was most noticeable in Workshop 4, which looked at the effects of culture, group identity and social pressure on independent thought. In contrast, only four participants regarded this as important to critical thinking before the course. Six people said the course had an impact on their own thinking in this area, but it was mentioned 17 times. So the workshops seemed to have had a significant impact here, although only on a few people. This may be linked to the stage the participants were at in their own critical thinking journey, as discussed in the next chapter.

Independence of thought or action was mentioned by only two participants from the February cohort, Hamra and Cyan. Hamra said that she was particularly inspired by the demonstration of the bystander effect in Workshop 5 (see p. 66) to take the initiative more in future, for example if she found herself in a potentially dangerous situation and no-one else was acting. Cyan, on the other hand, said he would only act on his anxieties about climate change if he was directed by a more powerful person or organisation.

Independence or initiative was considered important to critical thinking before the course by two participants in the May start cohort, Cyan and Helen (although Cyan also attended most of the previous course). However, five May start participants described this as a component of critical thinking after the course. Influences which participants thought might impinge on the students' independence included one's government (Joy); culture or family (Lohita, Joy); media, including social media (Jean, Joy); education (Lohita, Helen, Robin); and other people in general (Lohita, Jean). Helen claimed that although Taiwan is "more liberal" than mainland China, independence of thought is still discouraged in the education system: "we cannot argue with teachers, we have to obey". Differences in educational culture between the UK and the participants' home countries will be discussed in the next chapter.

Three participants said they had developed a more independent stance and were better able to think for themselves. Lohita and Dandan said this was a result of the workshops, but Robin appeared to be talking in general about his experience of developing critical thinking as a university student, not necessarily only on my course. Dandan said she realised that the opinion of the majority might not always be right. Lohita said that before Workshop 4 in particular, which examined the effects of peer pressure, she had difficulty being critical even

in her assignments. She believed that this was because her compliant nature made it uncomfortable for her to disagree with anyone or refuse to do what they wanted. She said:

> I generally mould myself into other person's way. So, at some point it creates frustration… Because you don't want to do it, sometimes … Now I think I have started saying "no" [laughs] ... and I try to change the talk in a way, like, it doesn't get rude, but the other person understands me like OK, why she don't want to do it … Before it was like 'oh, I don't want to do it but they are friends, or they are relatives, I have to do it'.

Lohita describes this change in terms of her personality. However, she is from India, which raises questions about whether the Western concept of critical thinking, with its emphasis on independent thinking and resisting peer pressure, is at odds with the cultural background of some of some international students. This issue is explored in more detail in the Discussion chapter.

Only two participants from the October start cohort, Portia and Olivia, considered independence or initiative to be part of critical thinking before the workshops. After the course, five participants, Yaling, Olivia, Sam, Hilary and Ayşegül, said or implied that they now thought it was important to critical thinking. Hilary and Yaling complained about the restrictions on independence and initiative in the Chinese workplace in their interview; "everybody should obey that rules. Although sometimes it may be wrong (Hilary)"; "they [employees] have to obey the rules, not have critical thinking (Yaling)".

Yaling and Olivia said the course had led to the realisation that they had previously taken their cue from their government or peers. Yaling said that "maybe I was just influenced by the government" and that "we trust the thing we want to trust". Olivia recounted her experience of an earthquake when she was at school; at first "nobody move in our classroom. And, after … ten seconds … someone shout, like, 'let's run out of the classroom'. So that's when we ran". Both claimed that they were now better able to think independently. Yaling and Olivia, who are Chinese, said (in separate interviews) that they had previously thought (or claimed to think) that climate change was a serious problem because their government had said so. Now that the workshops had encouraged them to challenge assumptions and think independently, they now questioned this official stance on the issue and wondered if climate change was not such a severe threat after all. This outcome is thought-provoking for me as a climate change activist and as a teacher focusing

on critical thinking; I will return to it in the section below on Research Question 4 and in the Discussion chapter.

One of the May start participants, Helen, also said that the workshops had made her reconsider whether the "mainstream" view of climate change as a man-made phenomenon was accurate. I will also return to this comment in the section on Research Question 4. However, it is also noteworthy that Helen suggested that she would be sceptical of any perspective of an issue (e.g. homosexuality or climate change) *because* it is mainstream. It is possible that the process of becoming a critical thinker can involve a shift at some stage from complete trust in an authority to scepticism about everything, at least temporarily, and this idea will also be discussed in the next chapter.

This factor is more salient for participants in the May and October cohorts, especially after the course. It is unclear why this might be, but it is possible that Workshop 4, which was quite complex and covered a great deal of theoretical ground, was better delivered in May and October, as I had practised it and revised it. However, as noted above, sample sizes are too small to be certain that the differences are not merely due to chance.

Multiple perspectives

Looking at issues from multiple perspectives was seen as an important part of critical thinking both before and after the course. 12 of the 23 participants mentioned it at interview a total of 16 times, making it the joint third most salient factor in terms of numbers of participants (along with "framing" and "independence and initiative"). 15 people said that the workshops had had an impact in their own thinking in this area. This was discussed in more detail in the section on Research Question 1 (see pp. 100 - 102).

Culture

Awareness of culture was the fourth most prominent element of critical thinking at interview after the course, with 10 participants mentioning it a total of 13 times. Workshop 4 in particular explored the influence of culture, as well as peer pressure and socially constructed silence, on critical thinking.

None of the February start participants said they thought culture was relevant to critical thinking before the course, but three mentioned it at interview. Sophia said that an understanding of culture might help her to appreciate others' perspectives. Cyan thought that "background and culture" might cause "bias". Violet, who is from Taiwan, claimed that critical thinking was lacking in her country, and in Asia generally. Two participants, Jade and Cyan, thought that the workshops had had an impact on their thinking by giving them a fresh perspective on the cultural mindset in their own country, China. Cyan said he thought that British people were better than Chinese people at taking the initiative rather than awaiting instructions in a potentially risky situation, for example when a fire alarm goes off. Jade considered for the first time the possible threat to personal privacy posed by the wide use of security cameras in China when she learned of the concerns about the use of surveillance technology in other countries.

From the May start cohort, two participants, Lohita and Joy, claimed to be more aware of the influence of culture on critical thinking after the course. They also said they were more aware of the influence of culture on their own thinking. Joy said, "it already shape us, you know, our personality, the whole person, are formed by our culture, or the past experience". Lohita thought that culture "really influence your way of thinking and perspective".

From the October start cohort, four participants, Hilary, Yaling, Sam and Olivia, indicated that they had been aware of culture as a factor in critical thinking before the course, especially social norms, rules of behaviour and the effects of patriotism on beliefs in their home country of China. Hilary and Yaling talked about socially constructed silence and peer pressure in their culture, and Sam expressed his surprise at learning that such phenomena exist outside China. Yaling also said that Chinese managers did not want to employ graduates with critical thinking because "they [the employees] have to obey the rules". Olivia said that she found it difficult to accept the different views of her (presumably non-Chinese) room-mates on Chinese issues: "I hate that China only tell me the one story they want to tell. But I love China because I grow up there, and - there's something I believe, I can't change it, 'cause I really think that's true, 'cause I live there for 20 years". In the Discussion chapter I will further explore international students' attitudes to Western concepts of critical thinking (for example the idea that independence of thought is

preferable to conformity), and the effects of patriotism and identity on Chinese students' experience of learning about critical thinking in the West.

Five participants from the October start cohort, Yaling, Olivia, Max, Sam and Hilary, indicated that they were aware of the relevance of this factor to critical thinking after the course, sometimes using newly learned terminology; Hilary thought that the obligation in her culture to obey company rules that were "wrong" was an "elephant [in the room]", and Olivia said that "'framing' and 'in-groups' help me understand that people from different backgrounds would think diversely". Three of these participants, Yaling, Olivia and Max, along with Rose and Ayşegül, said that they were now more aware of how cultural norms might influence their own thinking. For example, Rose and Ayşegül said they were now in a better position to compare Western thinking with that of their own culture, and Olivia said that thanks to Workshop 4, which included some cultural theory, "I realized I'm an individualist and supporting the hierarchical system."

It would appear that the October start participants were more aware than the other participants, both before and after the course, of the relevance of culture to critical thinking. It is possible that these participants were more conscious of cultural differences because they had travelled to the UK from their own countries more recently than the others (in most cases). Olivia, however, had done her undergraduate degree in the UK, so the differences may simply be due to chance and the small sample size.

4.2.3 Research Question 3: Do students feel that exploring these factors in workshops has an impact on their own critical thinking, and if so, how?

I will attempt to answer my third research question by looking at the areas where participants reported an impact of the workshops on their own critical thinking. As explained in the Methodology chapter and earlier in this chapter, items were put into an "impact" subcategory if they noticed the relevant factor or tendency in their own thinking, or if they said that their thinking in this area had already changed or that they intended that it should.

In brief, participants reported the greatest impacts on awareness of confirmation bias, seeing issues from multiple perspectives, respect for others' views, self-awareness, and the

use of evidence and sources. Students also reported a deeper understanding of critical thinking in general, which I will discuss first, followed by the categories "workshops are useful or engaging" and "difficulties and challenges", before moving onto the more specific areas where impacts were reported. I will finish the part of the analysis relating to the third research question analysis with the category "critical thinking as process". The possible effects of the workshops on the students' critical thinking will be further discussed in the next chapter.

Deeper understanding of critical thinking

The vast majority of participants, 21 out of 23, reported a deeper understanding of critical thinking after the workshops. Items were put in this category if participants said that the workshops had improved their understanding of critical thinking *in general*; (see Appendix 4). Some participants in all three cohorts said that they had enjoyed learning about the theories behind human thinking and behaviour; seven of the items in this category included this idea. Several said that they were newly aware of factors that could influence their own thinking: for example, among the items in this category, confirmation bias was mentioned six times. Participants on each course said that they found the activities more interesting and helpful than learning critical thinking through reading and writing as they had done in ELTC or in their departments; this is discussed further below.

Five of the February start participants (not Jade) said that they lacked confidence in their critical thinking before the course, or now thought that it had been deficient. The same five said that after the course they had a deeper understanding of critical thinking in general, or that learning about factors such as confirmation bias or framing led to improvement in their own critical thinking. Two participants, Violet and Hamra, compared this course favourably with regular ELTC courses where they learned about critical thinking through reading and writing activities. Violet said that the ELTC courses were "not as deep" as the workshops, which "almost feel like a module, and we learn about theory of the concepts." Hamra said:

> I think it's good if we take critical thinking as a course because we focus on the way to think how … in the [ELTC] class we just focus on critical thinking or writing. We question what we will read, we analyse, blahblahblah, but, when we take it as a normal in our life, it's good because sometimes we do not notice … why we did that, but after we, uh, take this lessons, we understand a lot of thing, why we did it, ah, how we can improve it

Hamra went on to say that the workshops helped her understand human behaviour better (for example failing to react to a fire alarm because no-one else does). Violet also said that the course had taught her that even numerical data should be treated with critical caution; "I didn't know that even number can have risk, a number, a figure can be possibly not as accurate … I always thought that the figures are like the truth!" The concept of knowledge as objective truth will be further explored in the Discussion chapter.

All nine May start interviewees said, a total of 16 times, that the course gave them a deeper understanding of critical thinking. Among the reasons given for this were: that the workshops had broadened their own minds; that it they realised critical thinking included many factors (rather than simply, for example, looking at positive and negative aspects of an issue); that they were newly aware of factors that could influence thinking; and that they noticed bias in themselves. Dandan said that the workshops gave her the opportunity to "examine [her] learning", and Lohita that it gave her the "support" she needed to be critical in her assignments. Mary suggested that her postgraduate studies had not given her a sufficient understanding of the concept:

> Before the course, I think that critical thinking is - I only know the word, critical thinking. I know when I write my dissertation I need to think more and have some critical thinking, but I don't know how to exactly do it. After the course, I think I know something about it.

The course also seems to have had a significant impact on the October start participants' critical thinking. All but one participant (Sam) said or suggested that they had a deeper understanding of critical thinking as a result of the workshops, and this was mentioned 22 times. Some participants said that the course helped them appreciate different aspects of critical thinking, and others that it explained some of the theory and concepts behind it. Like Hamra and Violet, Max, Portia and Olivia said the workshops were more useful than their regular lessons or lectures for learning about critical thinking. Max suggested that he benefitted from attending a course that focused on critical thinking outside of his discipline:

> … before, my past education, and all the university experience I don't have opportunities to take this lesson, like this … This is good way… And I guess it can give us a basic theoretical knowledge, in our mind. In fact, for the reference book, it includes some chapters about the critical thinking. In fact, before the lesson, I don't understand it, and I just have the concepts, and not clear concepts, but I can't really say I understand it

Portia also thought that "this kind of workshop is very useful, very useful than the lessons, compared to my department's courses." Olivia said, "I would really appreciate more critical

thinking related courses as I find this skill is significant for not just academic study but also in life".

In the Discussion chapter I will examine the possible advantages of teaching critical thinking in isolation, that is to say, outside the context of the usual language based EAP activities or of the academic discipline, and of focusing on what participants called the "theory" and "concepts" behind critical thinking.

Workshops are useful or engaging

Most of the participants, 15 out of 23, said they found the workshops useful or engaging, a total of 28 times. Their reasons included: enjoyable and student-centred activities, such as games, simulated experiments, role-plays and discussions; interesting topics; clear explanations; the acquisition of new terminology; and learning about how critical thinking might be applied outside the classroom (which is explored further below in the section about "critical thinking applied to study, work or life"). Agnes said that "before I attended this course, I thought critical thinking is very boring and difficult", suggesting that she had enjoyed this new angle. These responses suggest that the way I ran my workshops, which combined a student-centred constructivist approach with some teacher-centred exposition as described in the Methodology chapter (see pp. 48-49) was successful, at least from the participants' point of view.

As mentioned in the section above, some participants also said they enjoyed learning about theories and concepts behind critical thinking. Helen said she came to the workshops because she found it difficult to apply critical thinking, and she wanted help to "break down the concept, because the concept is too abstract". Joy said that although she had expected the course to cover "how to avoid some problem on critical thinking", she found that learning about these theories had highlighted influences on her thinking of which she had been unaware. Olivia admitted, to the amusement of us both, that "I still don't know what critical thinking is!" but added that she was now capable of being a critical thinker thanks to what she had learned in the workshops about the theories and concepts behind it.

Eight out of nine of the October start participants said they found the workshops interesting or useful, as opposed to three out of six in for the February start cohort and four out of nine for the May start cohort. It is possible that this is because I had run the course twice already, and so had had the opportunity to improve both the workshops and my delivery of them. In addition, the participants who agreed to be interviewed were those who had chosen to stay to the end of the course. As noted in the Methodology chapter, I never found out why some participants stopped coming, and they had no obligation to tell me under the conditions of my ethical approval. Those who found the workshops boring, overly difficult or unhelpful would have dropped out by then, so there would be no contributions from them in the data.

Difficulties and challenges

Although, as discussed above, most participants said they found the workshops beneficial to their critical thinking, many continued to find critical thinking difficult or challenging. Over half the participants (13) mentioned this, a total of 20 times. This suggests that developing critical thinking may be a long and difficult process, an idea which is further discussed below and in the next chapter.

In the February start cohort, three participants talked about continuing difficulties with critical thinking a total of five times. For example, Cyan said, “Even currently I’m not sure I have a right understanding about critical thinking”. Three of these instances were also counted in the category “Critical thinking as a process”, indicating that these challenges are part of this process, as discussed below.

Similarly, in May, six participants mentioned difficulty, a total of 9 times. Reasons for this included not knowing exactly what critical thinking was or how to “do” it; as well as difficulties in coming up with their own ideas, finding evidence to support them, and maintaining their independence of thought in an age of social media. One participant, Helen, spoke of “struggling” and “getting lost” when she first came to the UK because of these challenges.

In October, four of the participants also reported struggles with critical thinking, for various reasons. One said that, at first, she had found it difficult to distinguish between the

different concepts presented in the workshops, and two more that they found that critical thinking required them to "break the rules", which they found challenging. The fourth participant, Olivia, reported confusion, alienation and pain. This was because during the course of her studies in the UK, she discovered views about China held by other students and presented in her Global Relations module that contradicted what she had been told when she was growing up there, and she felt caught between her patriotism and her desire to understand different perspectives, as seen above. The relationship between Chinese national identity and critical thinking is revisited in the next chapter.

Confirmation bias and multiple perspectives

The workshops appeared to have the greatest impact on awareness of confirmation bias and on multiple perspectives, on the basis of the number of participants who talked about these factors, which was 13 in each case. Confirmation bias was mentioned slightly more frequently than multiple perspectives, a total of 18 times as opposed to 17 times. These two categories were discussed in more detail under "Research Question 2" above.

Respect for others' views

Respect for opinions that one may disagree with is the second most "popular" category where students report an impact on their critical thinking, with 12 of the 23 participants mentioning this a total of 24 times. However, none of them said they considered this important to critical thinking before the course. Workshops 1, 3 and 4 all contained elements that would contribute to this aspect of critical thinking, but so would all the discussions students had with each other, especially on their world-views and on cultural and social norms.

Two of the February start participants said that after the course they were more open to considering issues from other people's perspectives and appreciating why they might be different from their own. Melina said that she now understood that "[w]e have to criticise [an article from] lots of points of view. And something seems not good for me, this article, maybe it seems good for someone, so I have to think about that". Sophia said that "You keep asking me, thinking about the other people's perspective. After listening to other

classmates, I get the point. I should guess what other people say. What's their standing point?"

Two of the May start participants said that they thought this kind of respect was an important element of critical thinking after the workshops, and three reported an effect on their own thinking in this area. For Dandan, the concept was now key to her understanding of critical thinking and she would try to "respect others' view even I don't agree with them". Cyan said that instead of refusing to recognise some views because they were "bad", he now thought he could respect everybody equally. As discussed above, Lohita said that before the course, she used to pretend to agree with people to avoid conflict, but now she thought she knew how to politely disagree and still show respect for them. Lohita also said that I had created a classroom atmosphere where students could talk about potentially difficult issues such as cultural differences without causing offence.

From the October start cohort, three participants regarded respect for views not one's own as an element of critical thinking after the course, and seven reported that they were now more open to considering issues from other people's perspectives and appreciating why they might be different from their own. At interview, this factor was mentioned eighteen times. For example, Abda advised his fellow interviewees not to judge people; "we have to understand the reasons, what they did that. Sometimes when you listen to the reasons, ah, you will be persuaded!" Sam thought that "Maybe we should just accept the difference between people", and Yaling admitted that "I used to judge people by myself, by my own rules", but now was more tolerant of differences. Max, like Lohita, said that he had been impressed by how the "open-minded" atmosphere of the class allowed everyone to express their point of view with "no anger" or conflict.

The course seems to have had more of an impact in this area for the October start participants than for others. The October start students had arrived at the University most recently and so had less experience of studying at the ELTC or in their department. So it is possible that the other participants had encountered this aspect of critical thinking already, meaning that my course had less impact, but it is impossible to say for sure.

Self-awareness

The workshops appeared to have the third greatest impact on participants' self-awareness, that is to say, awareness of their own thinking processes, with 11 of them mentioning this a total of 24 times. This was not mentioned as relevant to critical thinking before the course by participants in any cohort. All six workshops aimed to make students more aware of some aspect of their own thinking processes and those of other people.

Two participants from the February start cohort, Hamra and Violet, said that the workshops had made them more aware of their own thinking and of the need to avoid biases. Hamra said that she now realised that people did not always notice the true motivations behind their own behaviour, "but after we take this lessons, we understand a lot of thing, why we did it". Violet said that when doing her research "[the course] reminds me of like, OK, I have those [barriers], and then try to be aware of that … So, yeah, be aware of yourself … you know that you might be doing those [things], so you try to avoid".

In May, although no-one specifically described self-awareness as an element of critical thinking either before or after the course, six participants said the course had increased their self-awareness, and they mentioned this a total of eleven times in interviews. It was sometimes described in terms of feeling a change in the quality of their thinking, for example from narrow to broad (Lohita), from shallow to deep (Dandan) or from simple to complex (Joy). Dandan and Joy also reported new awareness of their own bias, as did Mary, Jean and Agnes. Joy claimed that

> Chinese education is not care too much about criticise something, yeah, we learn more about some skills, and like how to gain the skills, how to train ourselves but we don't care about too much to be critical, to try to criticise the opinions, the others and ourselves, it's not so important.

This suggests that perhaps Joy is ready to shift from a skills view of education, as "training", to a perception of education that includes a dispositions-based view of critical thinking and values reflexivity. The relevance of different models of critical thinking will be further explored in the Discussion chapter.

Self-awareness was mentioned a total of 23 times after the course by six of the October start participants, three of whom claimed that the course had made them more aware of their own biases, world-view or stance. Max listed the factors that he should now consider

when assessing risk and probability, such as "optimism, and future discounting, and availability bias, and [the] bystander effect". Yaling acknowledged that she used to have an unquestioning trust in authority that shaped her views on, for example, climate change. She still struggled sometimes to accept other people's points of view but was aware of shifts in her own thinking: "maybe I have the cultural bias … and I am changing". Olivia realised that she was sometimes hypocritical, for example continuing to eat meat even though she did not like the thought of killing animals. She even said that the course helped her to "rethink my life experience and identify myself".

Olivia also recounted the time when an earthquake shook her school classroom, and only the boy known for disobeying rules took the initiative and shouted for everyone to evacuate, teaching her that "when you are a good student, [it] don't mean you are a good person in the society". This perhaps suggests that she is considering how critical thinking might prepare a person to become "a critically engaged citizen of the world", in other words, to develop "criticality" (Davies and Barnett, 2015, p. 16). (See the Discussion chapter, p. 160).

Use of evidence and sources

The use of evidence and sources is the element of critical thinking where the impact of the workshops on the participants appears to have had the fourth biggest impact on the participants, with 10 of them mentioning it a total of 12 times. This aspect of critical thinking is discussed in more detail in the section about "Research Question 2".

Critical thinking as a process

In the sections on "independence and initiative" and "difficulties and challenges", I suggested that critical thinking could be seen as a long (and sometimes painful) process. I identified this concept in data from all three cohorts, and 11 out of the 23 participants referred to it a total of 25 times. The concept of critical thinking as a process will be further explored in the next chapter.

Five of the February start participants described critical thinking as a process, either directly or indirectly, a total of six times. Four of the May start participants did so a total of 14 times. Interviewees of both these cohorts framed this process in a variety of ways. Some saw it as a process of increasing self-awareness. For example, Violet said that "now I know more about … your frames and bias, so like you more aware of like, why is this hard, or difficult to have critical thinking?" She added, "It's not just like [snaps fingers] I want to do this and I instantly have that ability". Like Violet, other participants framed it as an ongoing and sometimes difficult journey on which guidance may be needed. Cyan said that "After the course I think I have a further understanding about critical thinking. But I'm not clearly sure the understanding I have now is right or accurate". Jean thought, "critical thinking, you need to keep training you know". Robin felt that "critical thinking is a process for me…. critical thinking is long away, but I'm on the way!" Other participants perceived the process as the acquisition of practical strategies for study or life. Sophia said, "I think learning how to be critical thinking in the class is just a start point. I think it's a practical strategy. We need to utilise these strategies in our reading or in our working, even in our life".

Two of the May start participants also described the process as the subjective experience of one's mind or personality changing. Lohita said that her increasing independence of thought was "a big change for my personality", and Cyan reported that his thoughts were becoming "weird". In contrast, Robin spoke about his increasing "control" of critical thinking as if it was a kind of tool. It is worth noting that these concepts are not mutually exclusive; Robin also used the metaphor of a "journey" to describe the progress of his critical thinking.

The difference in the way the process of developing critical thinking is framed may be a reflection of whether the participants see critical thinking as "skills" or "dispositions", or both (Davies and Barnett, 2015). I will return to this idea in the Discussion chapter.

In October, three people talked about critical thinking as a process, one of them at length. This participant, Olivia, talked about "grow[ing] up", but also of loss of confidence, inner conflict, alienation and pain, as described above in the section on "difficulties and challenges". One of the May participants told a similar story to Olivia's in a conversation after the workshop. Helen, who was a Journalism student from Taiwan, recounted that earlier on her Master's programme she had gone through a period of extreme confusion

and paralysis when she felt she could no longer write her assignments because everything she wrote was “fake”. This confusion was triggered when her friends from mainland China dismissed as “propaganda” BBC interviews with former detainees of Chinese “re-education” camps for Uyghur Muslims alleging human rights abuses there. Helen did not know whom to believe, but her tutor told her that accepting this kind of uncertainty was an important part of higher education. For both Olivia and Helen, the process seemed to be one of old certainties being broken down before confidence in one’s own judgement can be built up again. Cyan’s “weird” thoughts also suggests this. One of the other October start participants, Yaling, talked about changing as a person, but the third, Ayşegül, said she had come to the course to be corrected if her critical thinking was “wrong”. The Discussion chapter will further explore the idea that the development of critical thinking represents a shift away from certainty and deference to authority, towards greater tolerance of ambiguity and reliance on one’s own judgement.

The concept of critical thinking as a process or journey is considerably less salient for the October start participants than for those in the other two cohorts. This may be because these participants had arrived at the University most recently, and so were only at the start of this process. However, this would assume that they had not learned anything about critical thinking (as it is understood at UK universities) before their arrival in the country, which may well not be true. It is also notable that Olivia, who did talk at length about her own experience in this area, had been studying in the UK already for several years as an undergraduate student. (See the Discussion chapter for further discussion of the place of critical thinking in the student “journey”).

In addition to those above, I also identified the following, less salient, categories in my analysis. Some of the items appeared in other categories, such as “Workshops are useful or engaging” or “Critical thinking as a process”.

Critical thinking applied to study, work or life

Not surprisingly, several participants said critical thinking was important for study before the course: nine out of 23. The salience of this category recedes somewhat after the course, when only four participants said the workshops had an impact in this area. This may be because some participants now thought critical thinking was relevant to other areas of life. Overall, seven participants said they could now see how critical thinking could be applied to their daily lives, for example because they could better understand other people's thought processes; three of these said they were already applying what they had learned in the workshops. Only four participants spoke of using critical thinking at work. One participant, Sophia, said that what she had learned about understanding others' viewpoints would be useful in workplace meetings, but two participants from the May start cohort, Helen and Robin, and one from the October start cohort, Yaling, said that Chinese employers did not like their employees to display critical thinking, but to "obey the rules". Yaling's claim that conformity is valued above independent thinking in her culture is revisited in the Discussion chapter.

Neutrality or objectivity

Items were put in this category if the participants used the terms "neutral" or "objective", or any of their grammatical variants; if they talked about avoiding bias or being aware of the effects of emotion on their thinking; or if they seemed to be referring to a single, incontestable truth (see Appendix 4). Although only one participant alluded to objectivity or neutrality before the course, a total of six did so afterwards, and seven said the course had helped them to be more objective.

Nobody from the February start course referred to neutrality or objectivity, but three participants in the May cohort, Dandan, Jean and Robin, said that the course had had an impact on their thinking in this area. Dandan said she was more aware of the effect of emotion on her analytical thinking, as explained above in the section on "questioning and analysing". Jean said that she felt the need to "keep training our mind to think more objective", and Robin said that with experience, "you can actually feel some point is not right, it's not objective, you can feel it". Five participants cited neutrality or objectivity as a

component of critical thinking after the October course, with four of these saying or implying that they were more aware of their own lack of neutrality or objectivity as a result of the workshops.

I did not suggest to the students at any point in the course that critical thinking meant being without emotion or positionality. In fact, awareness of one's own stance and the role of emotion in forming it was discussed in several of the workshops. For example, in Workshop 5 in the first course, I demonstrated that the assessment of risk involves a subjective judgement about how bad a particular outcome would be. To do this, I presented a slide with statistics about increased risk of flooding in India due to climate change followed by a video showing the suffering caused to local people by flooding, and invited the students to consider which representation of the risk made it seem greater (for most participants, the video did). This prompted a discussion of whether it was a good thing that our judgement can be influenced by compassion in this way, and also of how important it is to be aware of the effect of such human factors on our own thinking.

However, this workshop did begin with a series of exercises demonstrating that human beings are not very good at calculating mathematical probabilities, and the suggestion that students should be aware of and avoid barriers to accurate risk assessment, such as stereotyping and the "gambler's fallacy". In fact, the whole course encouraged students to be aware of influences on their critical thinking such as biases, which participants may have interpreted as an exhortation to aim for objectivity or neutrality. My own view of critical thinking is that human beings can never be completely objective or neutral, which is why I believe it is important to have an understanding of the psychological and sociological factors that shape our thinking. However, I appreciate that my participants may have a different view of the ultimate goal of critical thinking development, which may be informed by an educational background or disciplinary tradition different to my own. The idea of the aim of education as the pursuit of objectivity and "truth" will be further explored in the Discussion chapter.

Problem solving

Problem solving was considered part of critical thinking by two people in February, Violet and Cyan. Cyan said the workshops helped him in this area by demonstrating that "critical thinking not only include problem solving, also include questioning the problem and think about the problem in different aspects". Cyan was also a participant in the May start course, where he was alone in identifying problem solving as an element of critical thinking. In October, three participants, Abda, Portia and Max, mentioned problem solving, two of whom, Abda and Portia, named it as a component of critical thinking before the course, whereas Max said after the course that it should be applied to climate change.

Logic

Items were placed in this category if they contained the word "logic", or its grammatical variants, in relation to critical thinking. (See Appendix 4). Only four participants in total, all Chinese participants from the October cohort, mentioned logic as a component of critical thinking, but they mentioned it nine times.

Sam said after the second workshop that some of his Chinese friends had not come back because they were disappointed that the first workshop had not been about "logic". This might illuminate the possible differences between my approach and the one they were used to in their country. As explained in the Literature Review, China has a long tradition of logic training "with little opportunity for discussion, questioning or the development of independent learning or critical dispositions" (Dong, 2015, p. 356). Contrasting concepts of critical thinking and the aims of education will be further explored in the Discussion chapter.

4.2.4 Research Question 4: Does using the topic of climate change in such workshops change participants' perceptions of the issue, and if so, how?

This section attempts to answer Research Question 4 by looking at the categories relating to climate change, and comparing what students said about them before and after the course. Table 3 shows the findings relating to this research question and is followed by a discussion.

Table 3: Findings of the analysis for climate change

Note: One participant, Cyan, attended both the first two courses. To avoid confusion, he has been counted separately as one of six participants in the first and one of nine participants in the second (indicated by an asterisk) but counted only once in each figure in the "Total" column.

** climate change	**February (out of 6 participants)**	**May (out of 9 participants)**	**Oct (out of 9 participants)**	**Total (out of 23 participants)***
BC: CONCERN IN PARTICIPANT ABOUT CC + **	2 *(2)*	9* *(9)*	8 *(9)*	19* *(20)*
BC: CONCERN IN PARTICIPANT ABOUT CC -	3 *(3)*	0	1 *(3)*	4 *(6)*
BC: CONCERN IN PARTICIPANT ABOUT CC ?: unsure or mixed	1**(1)*	0	0	1* *(1)*
AC: CONCERN IN PARTICIPANT ABOUT CC + and = BC	2 *(2)*	4 *(4)*	4 *(4)*	10 *(10)*
AC: CONCERN IN PARTICIPANT ABOUT CC + and > BC	3**(4)*	2 *(2)*	2 *(3)*	7 *(9)*
AC: CONCERN IN PARTICIPANT ABOUT CC -	0	0	1 *(1)*	1 *(1)*
AC: CONCERN IN PARTICIPANT ABOUT CC ?: unsure or mixed	1 *(2)*	0	1 *(5)*	2 *(7)*
PERSONAL ACTION ON CC +	2**(2)*	4**(4)*	3 *(4)*	8 *(10)*
PERSONAL ACTION ON CC -	0	3 *(4)*	2 *(4)*	5 *(8)*
BC: CONCERN IN OTHERS ABOUT CC +	0	0	0	0/24
BC: CONCERN IN OTHERS ABOUT CC -	2 *(3)*	3 *(3)*	0	5 *(6)*
AC: CONCERN IN OTHERS ABOUT CC +	0	1 *(1)*	0	1 *(1)*

AC: CONCERN IN OTHERS ABOUT CC -	2 *(2)*	2 *(2)*	0	4 *(4)*
CC AS A COLLECTIVE PROBLEM +	1 *(1)*	4**(8)*	6 *(10)*	11 *(19)*
CC AS A COLLECTIVE PROBLEM -	0	3 *(4)*	1 *(3)*	4 *(7)*
CC IN SOCIAL AND PUBLIC DISCOURSE +	2 *(2)*	1 *(1)*	1 *(3)*	4 *(6)*
CC IN SOCIAL AND PUBLIC DISCOURSE -	1 *(1)*	1 *(1)*	0	2 *(2)*
CC IN SOCIAL AND PUBLIC DISCOURSE ?: unsure or mixed	0	4 *(4)*	0	4 *(4)*
BC: AWARENESS OF DIFFERENT VIEWS OF CC	0	1 *(1)*	0	1 *(1)*
AC: AWARENESS OF DIFFERENT VIEWS OF CC	3 *(3)*	5 *(8)*	5 *(11)*	13 *(22)*
BC: PARTICIPANT'S KNOWLEDGE ABOUT CC +	2 *(2)*	2 *(2)*	2 *(2)*	6 *(6)*
BC: PARTICIPANT'S KNOWLEDGE ABOUT CC -	1 *(1)*	1 *(1)*	1 *(1)*	3 *(3)*
BC: PARTICIPANT'S KNOWLEDGE ABOUT CC ?: unsure or mixed	2 *(3)*	0	1 *(1)*	3 *(4)*
AC: PARTICIPANT'S KNOWLEDGE ABOUT CC + and = BC	0	0	1 *(1)*	1 *(1)*
AC: PARTICIPANT'S KNOWLEDGE ABOUT CC + and > BC	3**(3)*	1 *(1)*	2 *(2)*	6 *(6)*
AC PARTICIPANT'S KNOWLEDGE ABOUT CC – and = BC	0	1 *(1)*	0	1 *(1)*
AC: PARTICIPANT'S KNOWLEDGE ABOUT CC ?: unsure or mixed	2 *(2)*	2 *(2)*	1 *(1)*	5 *(5)*

In brief, the course seems to have had limited impact on the participants' concern about climate change, as this was high both before and after the course. This is reflected in the significant level of interest in tackling the problem through personal action. Despite their own concern, the participants did not appear to believe, either before or after the course, that other people cared about climate change, despite the fact that nearly half of them suggested that they saw it as a collective problem. 10 of the 23 participants spoke about the place of climate change in social and public discourse, but they expressed differing views of how prominent it is there. Although the topic appeared in each of the workshops, these do not seem to have been very effective at increasing participant knowledge.

On the other hand, the participants' awareness of different views of climate change appeared to greatly increase, to the point that some participants started to doubt that it was as serious a problem as they had previously thought. The impact of these workshops on the participants' perceptions of climate change will be explored further in the next chapter.

Concern in participants about climate change

In Table 3, items where participants expressed concern about climate change are indicated with a plus sign "+", items where there was a lack of concern with a minus sign "-", and items where participants were unsure how they felt or expressed mixed feelings are indicated by "?: unsure or mixed". For the "AC [After the Course]" subcategory, plus or minus symbols followed by "and = BC" are used where participants were equally (un)concerned before and after the course. Where the participants were more concerned after the course than before, the symbols "+ and > BC" are used.

Most participants reported personal concern about climate change before the course. 19 of them mentioned this a total of 20 times, while four said they were not particularly concerned about it and Cyan said (after the February start course) that he recognised the problem but did not feel personally engaged with it. After the workshops, 10 participants were just as concerned as they had been before, and seven said they were more so. One person, Yaling, said she was less concerned about climate change, and two people had mixed feelings; Violet because she was still unsure how she felt about it, and Olivia because,

like Cyan, she felt distanced from the problem. (The other four participants did not say how they felt about climate change after the course). So, the workshops do not seem to have made a significant impact overall on participant concern, although some individuals did report a change in attitude, and the participants' comments afforded interesting insights into their attitudes towards the issue, as discussed below.

Two participants from the February start cohort said that they were concerned about climate change both before and after the course (Sophia and Jade). Both still thought the climate was changing after the course, but, as we have seen above, Sophia said that she now wanted more information about how this was happening and to re-evaluate news stories about it that she had already encountered. It is unclear whether she now entertained some doubt about the existence or causes of climate change, or whether she just wanted to understand the phenomenon better. In any case, it suggests that the course had been successful in encouraging her to question (for example) what she read and heard in the news.

Three participants in the February start cohort said they had not felt very concerned about the problem before the course. One, Hamra, said she didn't "feel the danger of … climate change". Another, Melina, said that "It wasn't a very big matter for me, it was just an IELTS topic matter", a view that was echoed by Joy from the October course. A third participant, Violet, who is Taiwanese, said she had felt fatalistic about it: "when it comes, it will come". Climate change was already having serious effects on Taiwan at the time of the interview (Lee et al., 2019; Sun and Han, 2018), as on the rest of the globe. So this could be an example of future discounting (Kahneman, 2011), or another form of distancing from the issue (APA, 2011); Xue et al. (2016) argue that fatalism may play a particularly significant role in determining responses to risks from climate change in Asian cultures. Violet also said that she had thought that concern about climate change was the result of confirmation bias and media exaggeration.

Interestingly, a fourth participant, Cyan, said that he knew it was "a serious problem in the world", but because it wasn't part of his studies or his work, he did not care about it, so his item went into the "unsure or mixed" category. Research suggests that in order to feel concern about an issue like climate change, whatever its severity or global reach, people

need to feel that it is personally relevant (Marshall, 2014), a phenomenon which was discussed in the Literature Review (see pp. 32 - 33).

Afterwards, three of these four participants said they were more concerned about climate change. Two of them, Cyan and Hamra, said the images and human-interest stories about flooding in Workshop 5, described in the section on "neutrality and objectivity", strongly affected them and brought home to them the "real danger" (Hamra) of climate change. As Hamra explained in her interview, "we read the statistic but we do not feel anything, but after we watched the video and we watched the real situation we feel upset". This is consistent with research suggesting that emotional engagement is necessary for people to fully comprehend the risk posed by climate change (APA, 2011; Marshall, 2014). Despite being "shocked" by the video about flooding, Cyan felt he was too insignificant to do anything about climate change on his own. There is evidence that a sense of powerlessness leads to a diminishing engagement with the issue (APA, 2011; Krosnick et al., 2006), as mentioned in the Literature Review. Violet, who had felt fatalistic about climate change before, was now unsure how she felt. This may be because it takes time to process information or ideas about such a complex issue. However, she also said that climate change action was about "trying to protect the future", despite the information on the course about recent climate impacts, suggesting some future discounting or distancing remained.

In contrast, all nine interviewees from the May start cohort acknowledged climate change to be a problem before the course, although one, Joy, admitted that she paid little attention to it in her everyday life, despite the evidence that climate change is a "significant" issue. This might again be an example of distancing oneself from the problem (APA, 2011). Both the first two cohorts had been studying in the UK at least since the previous September, and some of them had also studied at the English Language Teaching Centre the summer before that. So one possible reason for the difference in reported concern between the second and first cohort is that the former had been at the University of Sheffield longer, and may have been exposed to more climate change information and activism. One of the May start interviewees, Joy, said that climate change was a common topic in English language exams, and by implication, English language courses. Another interviewee from this cohort, Agnes, claimed that it was a popular campaigning issue amongst students in her department, and

suggested that “only students or only scholars care about it”. This is consistent with research that suggests that responses to climate change are partly informed by group affiliation, as mentioned in the Literature Review (Marshall, 2014; Rabinovich et al., 2012).

After the course, four of the May start participants, Agnes, Cyan, Helen and Robin, suggested that they were as concerned about climate change as they had been before the course, and two of them, Jean and Lohita, said that the course made them want to take climate change more seriously. On the other hand, Helen (from Taiwan) said that learning about critical thinking had made her want to challenge “mainstream” views, for example that climate change was caused by human activity. She now wondered whether it was not simply a natural process, and said that more evidence might be needed to ascertain whether it was anthropogenic. As I mentioned earlier, Sophia, a Chinese participant from the February start cohort, also now wished to look for more evidence that news reports about climate change were accurate. Similarly, Yaling, a Chinese participant from the October start cohort, said that the workshops had led her to question information from her government which she had previously trusted about the seriousness of climate change, and that perhaps it was a result of natural processes. I have mixed feelings about this. As a climate change activist, it is somewhat frustrating that my workshops appear to have shaken a firm belief that climate change is real, serious and man-made. As an EAP teacher whose remit includes fostering critical thinking, I am pleased that they are now prepared to question a previously unexamined assumption. As a researcher, I am happy to be able to demonstrate that I have not “brainwashed” my students into sharing my position on climate change, but quite the reverse, in at least three cases. I cannot of course generalise from my small sample of participants from mainland China and Taiwan to whole populations. Nevertheless, it might be illuminating to consider how attitudes to climate change held by citizens of these countries may be shaped by their relationship to their governments, and I will do so in the next chapter.

For the October start participants, as for the previous cohort, concern about climate change remained high before and after the course. Eight participants described climate change as a serious problem before the workshops. However, one, Max, also suggested at the interview that it had been mainly of interest to him as an IELTS topic, as Melina and Joy had said. Another, Olivia, admitted that she had just written what she thought was expected of her in

the Pre-Course Task. Olivia said she really did not care very much about it as the people who were suffering from it now lived far away from her, and it would not destroy the earth for another one or two hundred years, suggesting some distancing and future discounting as referred to above. After the course, six participants said they thought climate change was an important or serious issue. (Interestingly, Olivia argued that although she did not find climate change personally threatening, she thought China should be seen to take action on climate change as this was good for international relations, a point I will pick up in the Discussion chapter)**.** My course does not seem to have altered the October participants' perceptions of climate change, at least in terms of their personal concern about the issue.

The October start participants show a similar level of concern about climate change to the second cohort, and a significantly higher level than the first cohort, despite attending the University for a much shorter time and therefore potentially receiving less exposure to the issue as an exam topic or to student activism, as described above. Although the sample sizes are small enough for this to be due to mere chance, it is also possible that increasing coverage in the media throughout 2019 has brought the issue to the attention of the cohort that began the course later in the year. This possibility will be discussed in the next chapter.

Personal action on climate change

13 students mentioned personal action on climate change, a total of 18 times. Just over half of these items were about making individual efforts to mitigate the problem, and the rest were about not doing so. In Table 3, items about personal action on climate change, whether participants are referring to themselves or other people, are indicated with a plus sign "+". Items about failing to take action are indicated with a minus sign "-". All the "positive" items turned out to be about the participants' own actions, and all the "negative" ones, with the exception of Abda's and Yaling's comments about not wanting to make unreasonable sacrifices, were about other people's actions. This reflects the contrast between the participants' own high level of concern about the issue and their belief that other people did not care.

Two of the February start participants said they were interested in climate change action. Jade said that she had already joined an environmental organisation. As discussed above, Cyan felt that his own individual action on climate change would make no difference, but "if someone or some organisation will suggest or advise all of us [to] do something, I will participate positively, actively!" The feeling of powerlessness sometimes felt by individuals in the face of the serious global threat of climate change (APA, 2011) was discussed in the Literature Review (see p. 36).

Cyan repeated his wish to take action in his interview after the May start course, and Lohita, Robin and Helen from that cohort also said they were already taking, or intended to take, action on climate change. Three of the May start participants did not believe that other people took personal action on climate change. Agnes said that before the course she "didn't realise the gap between what the researchers, the government said and what people do" and added that "only students or only scholars care about it" while "ordinary people" continued their environmentally unfriendly activities, like driving. Helen and Robin discussed the gap between knowledge and action at some length; Robin noted that "most of the country think the climate change is happened, but they didn't do actual action to [unclear: prevent?] it.", and Helen agrees:

> everybody just like blind, and oh [hand in front of face] we know it and we ignore it, just like OK because we can go to drink the Starbucks coffee and OK we can go to eat Mr Donald [McDonald's] and OK watch the Pikachu Detective, and we just ignore a very dangerous thing.

Apathy about, and denial of, climate change (Norgaard, 2009) were discussed in the Literature Review (see p. 34).

Three participants from the October start cohort, Hilary, Sam and Max, indicated that they thought individuals should take action on climate change. Yaling, Abda, Hilary and Sam discussed the importance of personal action on climate change in their group interview, including the difficulty of knowing what activities caused the highest emissions. Yaling and Abda suggested that restricting these might require unreasonable sacrifices. Yaling, warned, perhaps jokingly, that the fear of producing climate change-inducing emissions would result in people sitting inactive in darkened rooms or even killing themselves. She also talked about striking a "balance" between the needs of the economy and the environment. The idea that tackling climate change entails damage to the economy or a

drastic drop in living standards was touched on in the Literature Review (p. 33), and will also be revisited in the Discussion chapter. On the other hand, minor lifestyle changes often promoted as being effective against global warming (Marshall, 2014), such as reusing plastic bags, were supported by many students in Workshop 1, despite the fact that the feedback to the climate change quiz revealed that the actual carbon savings are negligible (Berners-Lee, 2010). Views that participants might hold about what constitutes appropriate action on climate change will also be explored in the Discussion chapter.

Concern in others about climate change

In Table 3, items where participants say other people care about climate change are indicated with a plus sign "+". Items where participants say they do not care are indicated with a minus sign "-".

When participants spoke both before and after the course about others' attitudes to climate change**,** it was generally to say that most people did not care very much. Eight students across the cohorts said a total of 10 times that they did not think other people cared about climate change (one student said this both before and after the course, so the figures appear to add up to nine).

The participants gave various reasons for this lack of concern in others. For example, Hamra said "there is no awareness about it". Helen claimed that people underestimated the danger; "it's like, you cook the frog, in warm water, in a pot, because it's not hot, it's only warm, so nobody feels it's urgent". She also explained (as described above) how people can acknowledge the problem while deliberately ignoring it. Melina was surprised to learn about outright denial of climate change: "Even though I didn't get it as a big matter in the past, but I still believe in it ... But I didn't think that there are people actually against, and that they don't believe in climate change". Dandan explained how feelings of security in developed countries led to a lack of concern. Joy suggested that the topic was absent in conversation and in the media: "[i]f data is used for reference, climate change is very significant, but people usually don't feel it in their daily life. Without news and research articles, the severity of climate change is hard to get attention". These reasons for lack of concern about

climate change were discussed in the Literature Review, and will be revisited in the next chapter.

Climate change as a collective problem

Although, as discussed above, some participants did not seem to think that other people cared about climate change, nearly half of them (11 out of 23) described it as a collective problem in some way.

Cyan described it as a "social issue, which is worthy [of] everyone's attention". Helen and Robin saw it as a challenge that "we" face, and talked about the importance of building a grassroots climate campaign. Agnes saw it as "a global problem", but thought that Western countries shirked their responsibilities for it. Similarly, Helen argued in her Pre-Course Task that rich industrialised countries with high emissions have "exploited" poorer countries by not signing the 2015 Paris agreement. However, Dandan argued that climate change would not affect developed countries; she claimed that a rich nation like Norway would be able to preserve its "normal and excellent" climate in isolation from disruption suffered elsewhere, perhaps suggesting an incomplete understanding of the science.

Five participants from the latter two courses said that climate change required international cooperation between governments. In fact, Olivia suggested that the only good reason for China to take action on climate change was to maintain international status, as seen above. The role of domestic measures by individual governments, such as law- or policymaking, or giving information to the public about how to reduce their carbon footprint, were also discussed by participants starting in May (Agnes and Robin) and October (Olivia, Abda, Hilary, Max and Sam). There was some criticism however of government inaction and hypocrisy by Hilary and Sam, and Abda also pointed out that encouraging citizens to reduce consumption would reduce tax income, which recalls Yaling's suggestion that focusing on the environment threatens the economy.

It is not entirely clear why the concept of climate change as a collective problem should be more salient for the second and third cohorts than the first, although it is possible that, as suggested above, increasing coverage in the media throughout 2019 has brought the issue

to the attention of the later-starting cohorts. This possibility will be further discussed in the next chapter.

Climate change in social and public discourse

If climate change is "a global problem" (Agnes), which is "worthy [of] everyone's attention" (Cyan), then one might expect the topic to appear in both in social and public discourse, for example in private conversations or in the media. Ten of the participants spoke about the place of climate change in social and public discourse, although opinions about its prominence there were mixed. In Table 3, items where participants said they thought climate change was a prominent issue in social or public discourse are indicated with a plus sign "+", items where they thought it was not with a minus sign "-", and items where participants were unsure, or said it was prominent in only some kinds of discourse, are indicated by "?: unsure or mixed".

Dandan described climate change as a "hot topic around the whole world … this word appears almost everywhere". Sophia, Violet and Agnes said that there were frequent reports about climate change in the news, but at interview Joy disagreed with this, claiming that it was more common in English language tests such as IELTS and TOEIC. As mentioned above, Joy said in her Pre-Course Task that without such news coverage, it was difficult for climate change to receive any attention. Robin, citing news organisations in the UK and US, said that the news coverage varied according to the publication and the country.

In terms of personal engagement, Agnes claimed that it was a popular campaigning issue amongst students in her department, as we have seen, but that generally she considered it to be a special interest for "only students or only scholars". Jean pointed out that although people agreed that climate change was a serious problem when asked, they rarely brought it up spontaneously, suggesting they did not really think so. As well as echoing Hamra's claim about climate change that "nobody talk about it", this is consistent with research that suggests that it is difficult for people to take risks seriously if no-one around them does (Kahneman, 2011; Marshall, 2014). This phenomenon, called the "bystander effect" (see p. 33), was covered in Workshop 5. However, Olivia used the term "peer pressure" to refer to the way in which China has to be seen to take environmental action to gain the trust of

other nations and maintain "a global reputation". There is a question here about whether social pressure in relation to climate change has switched direction in the last few years, so that the topic has shifted from being a social taboo, as Marshall (2014) and Norgaard (2009) describe it, to an issue that individuals and nations feel they must at least pretend to care about, as Olivia suggested. This will be further explored in the Discussion chapter.

Awareness of different views of climate change

One noticeable effect that the course had on students' perceptions of climate change was that it greatly increased their awareness of different views on the issue. Only Robin indicated that he was aware of this before the workshops. 13 participants did so afterwards, mentioning it 22 times.

As we saw above, Melina was surprised to discover that some people actually do not believe that the climate is changing. Two other people from the February start cohort described the range of perspectives on this issue as potentially problematic. Violet said that "we learned from framing how different people, like businesspeople or politicians have framed this issue, so I guess it would be a very difficult issue, because everyone see it differently". Hamra said that

> everyone will look to the climate change, uh, a different aspect. For example, environmentalist will think about the environment, the economics will think about what will happen to the economy. And so, that everyone look from one side, no-one look to the big picture, everyone have, like, what they interest in or what they worried about.

Dandan, Hamra, Violet, Ayşegül and Max also spoke of their new awareness of the different possible framings of climate change, for example, as a moral, religious, economic, political or technical issue as well as an environmental problem. Lohita found talking to people from different countries about their experiences of climate change stimulating. Like Melina, Agnes had been unaware that some groups denied the existence of climate change, but Robin said that he was interested in "the debate between sceptic and protector. I want to explore … why do they have different opinions".

For Yaling and Helen, these differences of opinion are a reason to doubt previously held convictions on climate change, as discussed above under "independence and initiative". Max pointed out that solutions proposed by developed countries for the problem might be

unsuitable for developing countries. China is classed as a developing country by the World Bank (2020), so he might have been defending his country against possible criticism about their record on climate change. Wang (2017, p. 294) cites Wu (2009, p. 162) who found that Chinese media responded to "finger-pointing" at China's greenhouse gas emissions by arguing that developed countries should do more to curb their own emissions. The possible differences between attitudes to climate change of international students and UK citizens will be explored further in the next chapter.

Participant's knowledge about climate change

The main aim of the course was to explore factors affecting critical thinking rather than teach students about climate change, although the workshops did include some information about it, especially the first one. However, much of the course focused on how this issue is perceived, rather than on climate science. So perhaps it is not surprising that knowledge about the issue did not significantly increase, although six participants did seem to know more about it after the course than before (see below). In the Methodology chapter (see p. 88), I explained how I judged whether participants were displaying knowledge about climate change in these items or not.

In Table 3, items where participants seem to have some knowledge about climate change are indicated with a plus sign "+", items where they do not are indicated with a minus sign "-", and items where participants were unsure about the issue or show a partial knowledge are indicated by "?: unsure or mixed". For the "AC [After the Course]" sub-category, the symbols "+ and = BC" are used where participants are equally well informed before and after the course. Where the participants were better informed after the course, the symbols "+ and > BC" are used.

Six participants appeared to have some knowledge about climate change before the course, citing for example temperature rises and melting icebergs. After the course, several participants felt they knew more about it, although this was not certain. Abda accurately linked climate change with airplanes and recycling, but also conflated it with plastic waste and pesticide use. Lohita also conflated climate change with plastic waste. I realised in the first workshop of the February start course that some students knew less about the issue

than I had anticipated. So I began Workshop 1 of the latter two courses with a brief review of the causes and effects of climate change, and discovered that although most students knew about temperature rises and the effects of climate change on (for example) weather and sea levels, they did not all understand how emissions have led to the greenhouse effect which causes these temperature rises. This might explain how the specific problem of climate change became confused with other environmental problems.

Despite the overwhelming evidence that it is anthropogenic (IPCC, 2014a; NASA, 2020; Met Office, n.d.; UNFCCC, 2015), Portia suggested that the "real reason" for climate change had not yet been discovered, and Helen thought more evidence was needed to prove that climate change was man-made. Dandan seemed to think that climate change would adversely affect the production of oil rather than vice versa; despite my best efforts I was unable to ascertain exactly what she meant, but it is possible that she thought the type of oil that dominates the energy industry is produced from growing crops rather than extracted as a fossil fuel. Three of the October start participants said that information on how to cut one's greenhouse gas emissions could be found online if necessary, although Sam said that it was the government's duty to disseminate this kind of information**.** It seems then that using climate change as a vehicle for developing critical thinking does not necessarily mean that students will be better informed about it. The use of climate change as a topic will be revisited in the following chapter.

In the next chapter, I will discuss some of the areas highlighted in the analysis that I feel merit further exploration, particularly changes in the participants' understanding of critical thinking, the influence of culture, and critical thinking as a process.

5. Discussion

5.1. Introduction

The Discussion chapter examines my findings in more depth and with reference to the relevant literature. Many of my findings appear to be consistent with those of other researchers. However, as I have said previously, to my knowledge there have been no other studies that have taken a "generalist" approach to developing critical thinking with EAP students, an approach which my participants nevertheless found effective and engaging. My participants' attitudes to climate change also differ in certain respects to most of the research I have found in this area.

As I explained in the Literature Review (see pp. 19 to 21), for the purposes of this study I formed a conceptual framework based on three approaches to critical thinking outlined by Davies and Barnett (2015), that is, the "skills" view, the "dispositions" view, and the "criticality" view, although I proposed my own categorisation for dispositions, dividing them into those oriented towards ideas or information, towards the self, and towards other people. I studied Davies and Barnett's model before starting my analysis, but did not consciously aim to create categories that could be interpreted as skills or dispositions. I only devised my own classification of the dispositions after I had finished the initial stages of my analysis, that is, identifying the categories and counting how often they were mentioned and by whom. However, once formed, my new conceptual framework proved useful in helping me to make sense of the patterns I was now observing in the data, particularly where participants' understanding or use of critical thinking appeared to expand to include dispositions as well as skills, or to shift towards dispositions relating to understand one's own thinking and that of other people. This is explored further in Section 5.2 below.

This chapter explores the shifts in the participants' concepts of critical thinking described in the Findings and Data Analysis chapter in answer to the first two research questions, and the changes they perceived in their own thinking in answer to the third research question. Finally, I will discuss in more detail the participants' perceptions of climate change in response to the fourth question. In brief, participants' concept of critical thinking appears to have become somewhat more complex and nuanced as a result of attending the

workshops. The impact on their own critical thinking appears to be a shift towards critical dispositions related to the self and others. This is consistent with the finding that participants reported a deeper or broader understanding of critical thinking after the course, and that some seemed to be moving from a concept of truth as certainty to a greater tolerance of ambiguity. The workshops do not seem to have had much impact on participants' perceptions of climate change; they displayed a range of common attitudes to the problem, as described in the Literature Review, although levels of concern remained high. However, they displayed a greater acceptance of climate change as a mainstream issue, and less climate guilt, than I expected. At the end of this chapter I will discuss the ways in which their perceptions about climate change differed from my expectations, and the implications of using this topic for exploring the factors that were the focus of my workshops.

5.2 Changes in the participants' understanding of critical thinking

All the workshops in the research project used techniques described in the Literature Review as popular for developing critical thinking skills, that is: using questions to highlight aspects of critical thinking, discussion, participatory learning, problem-solving and case studies. The purpose of the course, however, was to raise awareness of psychological and sociological factors that affect human thinking, in order to increase students' self-awareness and their understanding of other's views. The participants' concept of critical thinking seems to have expanded from regarding it principally as a set of skills along with dispositions oriented to the processing of information, to include dispositions that aid self-awareness and understanding of other people's perspectives.

5.2.1 Questioning and analysing

As discussed in the Findings and Data Analysis chapter, before the course participants appeared to consider that "critical thinking" principally meant questioning and analysing, looking at issues from multiple perspectives, and building arguments. These can be considered as skills, although the information-oriented dispositions of inquisitiveness

(Davies and Barnett, 2015; Facione, 1990) and open-mindedness (Davies and Barnett; Facione, 1990; Thompson, 2002) are closely related to the first and second of these skills respectively. The participants' conception of these three skills appears to have broadened or become more complex in different ways, as discussed below.

That "questioning and analysing" was the most "popular" element of critical thinking before the course is perhaps unsurprising. This skill and the disposition associated with it are mentioned in Facione's commonly cited definition of critical thinking: "[it is] purposeful, self-regulatory judgement which results in interpretation, analysis, evaluation and inference … The ideal critical thinker is habitually inquisitive" (1990, p. 2). Davies and Barnett, in their review of approaches to critical thinking, identify both questioning and analysing as fundamental critical thinking skills (2015). In addition, questioning is a common technique for fostering critical thinking in both academia (Ahern et al. 2012; Jones, 2007), and EAP (Arnó-Macià and Rueda-Ramos, 2011; Maclellan and Soden, 2011; Tanaka and Gilliland, 2016; Wilson, 2016). Analysis is also closely associated with critical thinking in both EAP (Cottrell, 2011) and academia (Claris and Riley, 2012; Facione, 1990). So the participants would no doubt have encountered this perception of critical thinking as questioning and analysing in the UK either in their preparatory EAP studies, in their degree courses, or both.

However, the participants may also have been influenced in their choice by their educational background in their own countries. Nine of the 15 students who said that critical thinking was about questioning and analysing were Chinese. Although the Chinese educational tradition tends to discourage the questioning of authority or authoritative sources (discussed below), there is an emphasis on the logical analysis of arguments (Dong, 2015). Another two participants who identified this factor were from Saudi Arabia, where Islam exerts a strong influence on educational philosophy (Halsted, 2004). As discussed in the Literature Review (p. 32), Bali (2105) claims that the Islamic tradition of *ijtihad* values critical questioning of certain kinds of text.

Another possible reason why students associated questioning and analysing with critical thinking is the dictionary definition of the word "critical". The first definition given by the Cambridge Dictionary online is "saying that someone or something is bad or wrong", which implies questioning a proposition (2020a). This is what one of the participants, Melina, implied when I asked her where her idea of critical thinking came from. She replied,

"Because it's about the word 'critical'? When I think about 'critical' … I just think about the people who don't agree with anything".

However, as seen in the Findings and Data Analysis chapter (p, 96), before the course some of the participants were not sure *how* to go about questioning or analysing what they read or heard; for example, Hamra said "I don't know how to question the information", and Dandan and Hilary seemed to lack analytical tools. After the course, it appears that some of the participants had a better idea what questions to ask, or had the means with which to conduct their analysis; for instance, Ayşegül said that "It's this course gave me this kind of questions to ask".

As can be seen from Table 2 in the Findings and Data Analysis chapter, fewer participants described critical thinking in terms of questioning and analysing after the course than before. However, the vast majority did talk about how their understanding of critical thinking had deepened, broadened or become more complex as a result of the workshops, as discussed in the Findings and Data Analysis chapter (pp. 116-118). Learning that "there are many aspects" (Portia) to critical thinking was mentioned six times in the items in this category, and participants also said that increased self-awareness and learning about the "theory" or "concepts" of critical thinking had helped them become more critical. So although the category "questioning and analysing" seemed to diminish in salience after the course, many participants indicated that they now felt they had the tools to do their analysis, as Olivia claimed, or knew what questions to ask in critical evaluation, such as Sophia's "What's their standing point"? (See p. 121).

So it is possible that "questioning and analysing" appeared to become less salient because as the participants' concept of critical thinking had become more complex, they started to use other terms to describe the process of analysing and questioning, such as considering framing, looking for confirmation bias, or evaluating evidence and sources. In the Methodology chapter (pp. 87 - 88), I argued that critical questioning can be seen as the first step of analysis (Cottrell, 2011; Metcalfe, 2006). Metcalfe (2006) proposes that texts can be analysed by asking a series of questions, such as "How can the passage's contents be seen differently by rebounding the story around components of the passage?" (p. 37). "Rebounding" here means "drawing a boundary" around certain parts of the text. Metcalfe appears to be referring to framing as explored by the students in Workshop 3, when they

learned that frames work by "highlighting particular aspects of reality and hiding others" (Shaw, 2013). Tanaka and Gilliland (2016) and Paul (1984) argue that the analysis and evaluation of an argument requires an understanding of the world-view which frames it, which was also covered by that workshop. So arguably, when participants spoke of learning about "framing" in the interviews, they were also talking about the acquisition of a tool for critical analysis.

Another critical question which can be asked when analysing texts is "What is the driving force of the author?" (Metcalfe, 2006, p. 36). The author's motivation or stance can alert the reader to possible belief or confirmation bias as, for example, when the students in Workshop 1 learned that the source disputing the danger of climate change was a right wing think tank funded by the fossil fuel industry. Wilson (2016) argues that in the cognitive approach to critical reading, "sophisticated higher order strategies [include] identifying assumptions [and] detecting bias" (p. 5.) Tanaka and Gilliland (2016) claim that being aware of one's own biases is crucial to their model of "dialectical" critical thinking (p. 1), where issues are analysed through an exchange of views. So, awareness of confirmation bias, in oneself or in other people, can be viewed as another technique in critical questioning and analysing.

Two more of Metcalfe's (2006) critical questions relate to the evaluation of sources and evidence; "What are the inputs and outputs of the passage?" and "What other evidence is available?" (both p. 36). Although evaluating evidence is central to critical thinking (Facione 1990; Gupta and Ushur, 2012; Jones, 2015 and 2007), the vast majority of the evidence that students use in their argumentation and writing will not result from their own research, but come from sources that must also be evaluated for quality and reliability (Codita, 2016; Cottrell, 2011, Thompson, 2002). So the increased salience of the role of evidence and sources in the interview data after the course is perhaps an indication that students were better able to use this analytical tool.

5.2.2 Multiple perspectives

The second most salient element of critical thinking before the course was "multiple perspectives". The participants also said this was important to critical thinking after the

course, and it was also one of the areas in which they reported an impact on their own thinking.

The ability to see many sides to an issue is implied in Facione's description of the critical thinker as "open-minded" (1990). Acknowledging multiple interpretations of, for example, certain types of texts is also part of the Islamic tradition of *ijtihad*, according to Bali (2015); four of the participants are from Muslim-majority countries. One might think that looking at issues from multiple perspectives would be discouraged in China, the home country of most of the participants, judging by Olivia's complaint that the authorities there have "one story that they want to tell" (see p. 114). The tradition in Chinese education that there is only one authoritative version of the truth (Dong, 2015) is further discussed below, in the section on "culture". However, 11 out of the 12 participants who say that "multiple perspectives" are important to critical thinking before the course are Chinese. Looking at issues or information from multiple perspectives is practised in EAP (Codita, 2016; Tanaka and Gilliland, 2016; Thompson, 2002) and in academia (Jones, 2015; Toplak et al., 2013). So some of the participants may have learned about this aspect of critical thinking in the UK, either in EAP lessons or their departments.

Although this component of critical thinking is equally salient before and after the course, the participants' comments suggest that, as a result of the workshops, they had a broader understanding of what seeing an issue from multiple perspectives might mean. As Joy said, "before this course, my mind is really simple, just about both negative and positive side. But actually not that simple." As mentioned in the Findings and Data Analysis chapter, after the course participants in the May start cohort spoke of many points of view, as opposed to just two (p. 101). I also explained in the Methodology chapter (pp. 87) that the category "multiple perspectives" covers items that mention different "perspectives", sides" or "views", but is not specific about how an issue (such as climate change) might be framed (e.g. as economic, moral or environmental). Many of the participants described critical thinking as looking at issues from multiple perspectives, but none of them talked about framing, even indirectly, until after the course. The addition of framing suggests another way in which their understanding of critical thinking might have broadened, as explained below.

5.2.3 Framing

The concept of framing appeared to be new to the participants, but after the course it was one of the most salient categories. A closer analysis of the "framing" items in both "AC" and "IMPACT" subcategories shows that roughly a quarter of them relate to the framing of information, e.g. "climate change [can be an] economic issue, religious issue, political issue" (Dandan); a quarter to awareness of one's own framing, e.g. "[you should] avoid … the influence by your instinct … like framing" (Sam); and a quarter to understanding other people's viewpoints, e.g. "'framing" and 'in-groups' help me understand that people from different backgrounds would think diversely (Olivia)". (The last quarter were not specifically related to information, self-awareness or other people's perspectives). So the addition of the concept of framing may have enriched not only their understanding of how issues might be seen from multiple perspectives, but also increased both their self-awareness and their willingness to respect other people's views.

Unlike "questioning and analysis", the category "multiple perspectives" is salient both before and after the course. As I said in the Findings and Data Analysis chapter (pp. 97 - 98), in my view as a teacher, all the workshops dealt in some way with questioning or analysis, but the participants may not have seen it that way. After all, "questioning" and "analysis" are fairly broad terms. So when asked at interview about changes to their concept of critical thinking or the impact of the course on their own thinking, they may have found the new, more specific terms, such as "framing" or "confirmation bias", came more easily to mind.

On the other hand, four out of the six workshops had an explicit focus on other perspectives that may have been clearer to students. Workshop 1 deliberately placed in opposition sources that gave different answers to questions in the climate change quiz. It also encouraged students to question their previous beliefs or instincts if these were contradicted by sources that they themselves had judged to be reliable (Paul, 1984). Tanaka and Gilliland (2016), quoting Paul, describe how in their study on the "dialectical" model of critical thinking instruction (2016, p. 1), students engaged in the "unearthing of deeply rooted belief systems" in order to effectively "discuss and evaluate opposing viewpoints" (2016, p. 5). Workshop 2 strongly encouraged students to consider evidence supporting views not their own in order to avoid confirmation bias, as in Tanaka and Gilliland's study (2016). Workshops 3 (on framing) and 4 (on culture and identity) dealt largely with how

people come to have different perspectives at all. Workshop 3 demonstrated how we habitually frame issues according to our world-views (Paul, 1984), but that learning how to frame them differently can foster open-mindedness (Battersby and Bailin, 2013). Workshop 4 explored how our views are framed by our cultures, in-groups and social norms (Douglas and Wildavsky, 1982; Marshall, 2014; Norgaard, 2009; Rabinovich et al., 2012); understanding how other cultural frameworks might produce quite different views helps to avoid "sociocentrism" (Tanaka and Gilliland, 2016, p. 1). So when the participants were learning about conflicting sources, confirmation bias, framing and the effects of culture on thinking in the first four workshops, it may have been more obvious that these were all closely related to multiple perspectives. This may be why participants specified multiple perspectives as a critical thinking factor both before and after the course.

5.2.4 Argument building

As discussed in the Findings and Data Analysis chapter, argument building was the third most "popular" element of critical thinking after the course. 10 out of the 11 participants who mentioned this before the course were Chinese. These students may have been thinking of the logical analysis of single arguments traditional to Chinese education and described by Dong (2015). Sam, who is Chinese, suggested that he thought as much at interview: "critical thinking is about thinking in a logical way, like maybe find some drawback of their prove". (Sam also suggested that his Chinese friends might have dropped out of my course because it did not focus on logic, see p. 128). However, the more complex argument building necessary for most academic tasks is also promoted in EAP (Codita, 2016; Cottrell, 2011; Maclellan and Soden, 2011; Wilson, 2016) and in academia (Davies, 2013; Jones, 2007 and 2015), so participants may also have been thinking of this.

Argument building as an element of critical thinking is less salient after the course. It is used in productive language skills; however, the course was short, and there was no time for extended writing, or structured speaking activities, such as presentations or formal debates, which require the careful construction of detailed arguments (although they could of course do this if they wished, in the workshops' many discussions). This may be why participants did not say that the course had made much impact on this skill.

5.2.5 Evidence and sources

As noted in the Findings and Data Analysis chapter (p. 109), the "evidence and sources" category was less salient before the course than "argument building". However, it was a more "popular" category after it, even though building an argument in academic speaking and writing usually requires evidence and sources to support the points (Cottrell, 2011). Perhaps the participants thought this was obvious, and so did not think mentioning it was necessary. It is also possible that the students thought that argument-building meant thinking up one's own supporting details, rather than looking elsewhere for them. For example, students whose experience of essay writing was confined to tasks like those in the IELTS exam, where references are not required, might not automatically have associated argument building with the use of evidence and sources. This might have applied to the four February start participants (Hamra, Melina, Sophia and Jade) and the two October start participants (Abda and Sam) from the Pre-Sessional programme who had not previously attended the International Summer School at ELTC, where students learn how to use referencing. It might also have applied to the six in-sessional participants in the October start cohort who would not yet have been required to produce assignments with references by their department when my workshops started. However, it does not explain why, out of the nine May start participants who had been studying on their postgraduate courses for seven months, only two said that they thought the use of evidence and sources were important to critical thinking before the course.

However, the rise in the number of participants who said that the use of evidence and sources was an important part of critical thinking suggests a greater awareness of what is required to build convincing arguments. Workshop 1 in particular focused on the importance of reliable sources, and Workshop 2 on avoiding the temptation to ignore evidence that does not support one's existing beliefs. So it could be argued that the workshops may have enriched their understanding of argument building, even though fewer participants mention this skill after the course.

To sum up, after the course the participants seemed to have a broader understanding of three factors that they considered to be the most important to critical thinking before the course, i.e., "questioning and analysis", "multiple perspectives" and "argument building". The addition of five more elements to their concept of critical thinking - not only evidence

and sources and framing, but also confirmation bias, independence and initiative, and awareness of culture - also suggests that they may have developed a more complex and nuanced understanding of critical thinking as a result of the workshops. The last three of these factors will be further explored below.

5.2.6 Dispositions

As described in the Methodology chapter, each workshop explored one or more of the factors that affect thinking processes, in the hope that this would help the students to understand the workings of their own minds and those of other people better. If this was in fact the result, the data might indicate that participants' conceptualisation of critical thinking after the course included dispositions that are oriented towards the self, for example self-awareness, and towards others, such as respect for others' views, as well as skills and dispositions relevant to the processing of ideas and information (see pp. 19 - 20). The three factors that seemed to be most integral to critical thinking for the participants before the course can be regarded as skills, especially "questioning and analysing" and "argument building". In the Literature Review (p. 19), I suggested that the third factor, that is, awareness of multiple perspectives, may be considered as a disposition that is oriented towards information or ideas, or one that is oriented towards people, if one accepts that only human beings are able to hold different views of these. For some participants, it is unclear how exactly they conceptualised "multiple perspectives" before the course, e.g. as two sides of an issue or as many sides, or as an aspect of the issue itself as opposed to being dependent on the people viewing it. However, as discussed above, there are some indications that the addition of "framing" to participants' definition of critical thinking had helped to shift their concept of multiple perspectives towards a better understanding of their own perspectives and those of other people.

There are some other indications in the data that the workshops might have resulted in such a shift. Confirmation bias was the factor cited by the most participants as important to critical thinking after the course. Knowing how confirmation bias works, or even realising that it exists, means understanding that people are often deeply attached to their beliefs, (Evans, 2010) so they have a motive for "cherry picking" evidence that support them; a

concept closely related to “confirmation bias” is “motivated reasoning” (Leviton, 2007). This attachment to a belief may be because it provides a sense of security or identity, for example by allowing or maintaining access to an in-group (Evans, 2010; Marshall, 2014); another term for confirmation bias is “myside bias” (Toplak et al., 2013; West et al. 2008). Teaching about confirmation bias meant exploring these aspects of human nature with the students. After the course, over half of the participants said they were not only aware that other people were sometimes selective with their evidence, but they themselves were, too; some of these said they would try to avoid this bias in future (see pp. 107-108). This suggests a development of the dispositions of self-awareness (Kuhn and Dean, 2004; Papp et al. 2014; Thomas and Lok, 2015; Thompson, 2002) and critical self-reflection (Papp et al. 2014; Thomas and Lok, 2015), which naturally are oriented towards the self, and the disposition of otherside thinking (Toplak et al., 2013), as outlined in the Literature Review (p. 20), which is oriented to other people.

The factor that was cited as an element of critical thinking after the course by the (joint) third highest number of participants, “independence and initiative”, is equivalent to the disposition of “resisting authority or peer pressure” (Claris and Riley, 2012; Fahim and Hajimaghsoodi, 2014). “Respect for others’ views”, the second most salient category where participants reported an impact on their own thinking, has also been described as a critical thinking disposition (Davies and Barnett, 2015; Maclellan and Soden, 2011; Riggs and Hellyer-Riggs, 2014; Tanaka and Gilliland, 2016). Both of these (I have suggested) are oriented towards other people, whereas the area in which participants reported the third greatest impact on their thinking, “self-awareness” (Kuhn and Dean, 2004; Papp et al. 2014; Thomas and Lok, 2015; Thompson, 2002) is a disposition oriented, of course, to the self. An awareness of culture, which was the fourth most prominent element of critical thinking at interview after the course, will be discussed further in the section on “critical thinking as a process” below.

5.3 Culture

5.3.1 Conformity and independent thinking

In the Findings and Data Analysis chapter (pp. 111-112), I speculated that some participants may have found the concept of critical thinking as independent thinking to be at odds with the cultural norms of their home countries. Most of the students come from mainland China, where Confucian traditions of conformity and collectivism are arguably still quite strong, at least in education (Dong, 2015). According to Sun and Han (2018, pp. 3-4), Taiwanese society is also "traditionally characterized by the strong values and symbols of Confucianism and collectivism". Dong (2015, p. 357) contrasts this tradition of "the collective good, social order, and harmony" and "group thinking" to the classical Greek emphasis on "independent thought" that underlies Western notions of education. De Oliveira and Nisbett (2017) also argue that while individualistic societies, such as the UK, value freedom and self-expression, collective societies value "group harmony and conformity" (p. 785). This conformity is reflected in Yaling's claim that Chinese managers do not want to employ graduates with critical thinking because "they have to obey the rules"; Hilary added that they are obliged to follow these rules even if they are "wrong".

Two other countries which are also said to have collective societies are India (Shah, 2009), the home country of Lohita, the participant who said the course had taught her how to resist peer pressure; and Saudi Arabia (Jiang, Garris and Aldamer, 2018), where three of the other participants are from. Saudi Arabia, is, of course, a strongly Muslim country. Although Bali (2015), maintains that the Islamic tradition of *ijtihad* has traits in common the Western notion of critical thinking, Halsted (2004) claims that "independence of thought and personal autonomy do not enter into the Muslim thinking about education, which is more concerned with the progressive initiation of pupils into the received truths of the faith" (p. 519).

As mentioned in the Findings and Data Analysis chapter, the road to becoming a critical thinker can be difficult, and even painful. In some cases this may be due, at least in part, to this conflict between the respective educational traditions of the student's home and host countries. This will be discussed further in "critical thinking as a process" below.

5.3.2 Certainty and ambiguity

Tolerance of ambiguity is valued in the Western model of critical thinking (Claris and Riley, 2012; Davies and Barnett, 2015; Gupta and Ushur, 2012; Reid and Anderson, 2012). However, the traditions of Confucianism (Dong, 2015) and Islamic scholarship (Bali, 2015) which influence educational practice in most of the participants' home countries tend to value certainty and the concept of knowledge as fixed and indisputable. This is consistent with Dandan's wish to "examine the truth" (see the Findings and Data Analysis chapter, p. 108), with Olivia's preference for a definite "conclusion" to arguments (p. 101), and with Violet's assertion that before the course, "I always thought that the figures are like the truth!" (p. 117). It is also reflected in the reaction of one student (not an interviewee) in Workshop 1 to the idea of many possible truths (as detailed below). The belief that there is only one correct version of reality is not necessarily linked to culture (Kuhn and Dean, 2004). However, it is notable that the comments quoted above are from interviews with Chinese or Taiwanese participants, and the Workshop 1 student was from Saudi Arabia, all countries with Confucian or Islamic educational traditions.

Dong (2015) claims that the rise of consumerism and capitalism in China has eroded its collective culture. However, he adds that Confucian "dogmatism about truth and knowledge" is still dominant in education (p. 361), and that this is thought to be acquired by "reading the classical books without looking outside the windows" (p. 362). In other words, what counts as "knowledge" cannot be critically questioned, or challenged based on empirical evidence. This is reflected by Joy's comments that "in China … we are not thinking it is so important to use the reference" (p. 102), and that "Chinese education is not care too much about criticise something" (p. 122). According to Dong, the Confucian tradition leads to a view of education based on memorisation and rote-learning, and to a system where teachers, as holders of true knowledge, are resistant to challenge. As noted above, Taiwan's culture also has roots in Confucianism (Sun and Han, 2018). Helen claimed that although her home country of Taiwan is "more liberal" than mainland China, independence of thought is still discouraged in the education system: "we cannot argue with teachers, we have to obey" (p. 111).

One of my Saudi students (not an interviewee) dropped out of my February start course after the first workshop. This was the session where students completed a quiz about

climate change by choosing between true/false or multiple-choice answers, and were then told there was a plausible-looking source for each one. The purpose of this exercise was to demonstrate that there is often more than one possible answer to a question, and this is why it is important to check the quality of the sources behind each assertion and make one's own judgement about their credibility. The Saudi student was uncomfortable with this idea. "But which answer is true?" he asked.

Four of my research participants are from majority Muslim countries, three from Saudi Arabia and one from Turkey. In Saudi Arabia at least, Islam is a strong influence of education and society as a whole. Halsted (2004) argues that the status given to the Qur'an, the Prophet and the "learned" teachers of Islam in education means that concepts of "certainty" and "respectful humility towards … legitimate authority and trust in the truth of the knowledge that it hands down" are enshrined in the Islamic educational tradition (p. 525). Halsted claims that this certainty, and the "objective quality" of the goals of Muslim education, preclude the possibility of revising accepted knowledge in the light of new evidence. "The effect of this is to play down the importance of certain skills within education, such as questioning, verifying, criticizing, evaluating and making judgements, in favour of the uncritical acceptance of authority" (2004, p. 526). This is somewhat at odds with Bali's claim that the Islamic tradition of scholarship known as *ijtihad* overlaps with the Western tradition of critical thinking in that it promotes the practice of "evaluating the credibility of sources … and using logic to arrive at what are usually multiple divergent but equally valid interpretations" (2015, p. 319). However, as Bali herself says, *ijtihad* is principally applied to the interpretation of Islamic law. This is a specialist task for a class of legal experts called "mujtahid", to whose judgement lay people are supposed to defer (Encyclopaedia Britannica, 2018). So it is possible that this practice of evaluation and awareness of multiple perspectives does not extend to other areas of Muslim education.

Only one participant is not from a country with a predominantly Confucian or Muslim culture; Lohita is from India. There too, the emphasis on memorisation and rote-learning suggests a view that there is a single definitive version of reality that does not need to be challenged: "students are expected to apply more memorization and less using [sic] higher order thinking skills, such as analysis, synthesis, and evaluation" (Omnidvar and Ravindrahnath, 2017, p. 348).

This is another area, then, where there may be conflict between the international student's home culture and the critical thinking tradition in the country where they are studying. The move from an expectation of certainty to a tolerance of ambiguity and respect for differing views is part of the process of becoming a critical thinker. This shift in expectation is revisited in section 5.3.3 below.

5.3.3 Chinese patriotism and identity

Another source of difficulty for Chinese students studying abroad is that they may find their positive perception of their home country and its government challenged by other people for the first time. Hail (2015) reports that "[s]ome Chinese students complain that host country students want to talk with them about China but exhibit misinformed, prejudiced and offensive views of Chinese current events" (p. 312). Challenges to the view that Chinese students hold of their homeland often come in the form of questions or differences of opinion about the issues of Chinese sovereignty over Taiwan, Tibet or Hong Kong (Gao, 2011; Hail, 2015). Chinese students may then find themselves caught between loyalty to their country, which entails *not* questioning or challenging their governments' position on these "territories" (Gao, 2011), and the norms in Western academia that hold that any issue is up for debate and that differing views should be respected. This seemed to be at the heart of Olivia's discomfort when discussing Tibet, Taiwan and Hong Kong with her non-Chinese classmates (see p. 105).

Challenges to their beliefs about their home country are likely to be especially painful to Chinese students because they can seem to threaten their identity. Hail (2015) argues that

> [s]ocial identity theory posits that one's personal identity and self-esteem are closely related to one's membership within various social categories, such as race, nation, or ethnicity … For Chinese international students, cognitive awareness of national identity is particularly strong (p. 315).

Gao (2011) counts amongst the characteristics of national identity, "thinking of a nation's future interests", recalling Olivia's point that China should act on climate change to maintain good relations with other countries (see pp. 139 - 140), and "national body, which manifests itself in discussions of national territories", which would explain why some Chinese students can become defensive about the issues of Tibet, Taiwan and Hong Kong (Gao, 2011; Hail,

2015). Hail (2015) found that being in a minority in their host country made his research participants feel more strongly attached to their Chinese "in-group" and their national identity (p. 322), and both Hail and Gao (2011) note that these feelings of patriotism and defensiveness are likely to be intensified when students are abroad. Chinese students abroad also tend to conflate loyalty to their government with loyalty to their country (Hail, 2015). Hail's research participants noted that in a Western democracies like the US it is more acceptable than in China to openly disagree with one's government. Nonetheless, Hail found that

> When they were still living in China, it was easier to conceptually separate "the people" from "the government," and some interviewees reported that they often criticized Chinese government before coming to the United States. While abroad, however, the concepts of "the people" and "the government" tended to blend together as national identity became more salient (2015, p. 316).

It is difficult for any person to question beliefs that are at the heart of their identity, or to hear them challenged, no matter what they are told about the meaning of "critical thinking". Gao, whose research participants were students of English in the UK, notes that "since many Chinese learners relate national unification to their patriotism, it might be difficult for many Chinese learners to consider Taiwan independence just as an alternative view and then discuss the Taiwan issue calmly in the language classroom" (2011, p. 301). Hail contends that there are many reasons why students abroad have negative reactions to criticism of their home countries, such as patriotism or the wish to protect their own status in the classroom, so these should not be "hastily dismissed as irrational or chauvinistic 'nationalism'" (p. 322). At interview, Hail's respondents reported that they felt more comfortable talking about contentious Chinese issues when they understood that their non-Chinese classmates had no malicious intentions. One respondent actually came to this realisation through attending a critical thinking course. She said:

> we learned how to communicate with each other when we're from different cultural backgrounds and how can we learn to understand each other better … I think that module helps a lot in our communication. Even though I know that they can't understand what I want to say, I know they are trying to, and they are really open-minded (p. 319).

Hail suggests that a supportive atmosphere and a common in-group identity is necessary to a productive discussion (2015). As I explained in the Methodology chapter, I also did my best to build a supportive class atmosphere which allowed students to discuss potentially

difficult subjects. This included attempts to reduce the distance between myself and the students and strengthen the sense of a human shared experience. For example, I admitted to my own confirmation bias in Workshop 2 when I showed them the source of my data about male and female language use, and talked about my own struggles with cultural identity as an Anglo-Scot in Workshop 4 (which was about culture and in-groups), as described in the Methodology chapter (p. 90). The unprompted remarks of two participants suggested that I had been successful in building a mutually respectful learning environment (see p. 121). My experiences suggest that one of the most important qualities for teachers wishing to help their students with their own critical thinking trials is empathy.

5.4 Critical thinking as a process

5.4.1 Three models of critical thinking

As described in the Findings and Data Analysis chapter, nearly half of the participants described critical thinking as a process of some kind. Some of their comments suggested the acquisition of practical strategies or tools for study or life, which may indicate a *skills*-based view of critical thinking (Davies and Barnett, 2015). The process was also described in terms of a continuing and sometimes difficult journey. Above, I have discussed the obstacles presented by cultural differences, threats to national identity and loss of certainty. The fact that some students were conscious of these conflicts in their own minds is arguably linked to the growing self-awareness and the feeling of one's mind or personality changing that some participants experienced as their critical thinking developed. This, and the fact that "self-awareness" is one of the areas where participants noted an impact, is consistent with a *dispositions* view (Davies and Barnett, 2015).

I am not suggesting that participants held either one view of critical thinking or the other, or that they abandoned the idea of a set of skills and started to view critical thinking purely as a set of dispositions. Some participants clearly held both views, and I have argued that the workshops may have allowed their perceptions of critical thinking to expand to include a broader or more complex view that could accommodate both. There were also a few

indications that some participants were developing a *criticality* view of critical thinking, although not necessarily as a result of my workshops. Olivia implies this in her account of the earthquake where the student who was well-known for disobedience was the only one to take the initiative and evacuate the classroom: "when you are a good student, [it] don't mean you are a good person in the society" (see p. 123). Helen also demonstrated that before the course she was a "critically engaged citizen of the world" (Davies and Barnett, 2015, p. 16) when she uses the example of the increasing acceptance of homosexuality (see p. 113) to argue that the "mainstream" view is not necessarily the only view, or the right one.

5.4.2 From certainty to ambiguity

In the section on "culture" above, I argued that most of the participants came from cultures thought to favour certainty, conformity and deference to authority (Dong, 2015; Halsted, 2004; Sun and Han, 2018) but now find themselves in an academic culture which values a tolerance of ambiguity (Davies and Barnett, 2015; Gupta and Ushur, 2012; Reid and Anderson, 2012), independence of thought (Facione, 1990) and an ability to resist peer pressure and authority (Claris and Riley, 2012; Fahim and Hajimaghsoodi, 2014). So the process of becoming a "critical thinker" in the Western model may for some participants involve a shift from the expectation of certainty to an acceptance of uncertainty. As discussed in the Findings and Data Analysis chapter, this shift can be difficult. If education is no longer the pursuit of a single indisputable truth which is arbitrated by an authority with the power to settle any doubts or questions, then students themselves bear the responsibility of judging what is credible or reasonable for themselves, and may have to leave some doubts or questions unresolved. Olivia and Helen's comments suggest that they may initially have lacked the confidence to take this step. I mentioned in the Findings and Data Analysis chapter (pp. 124 - 125) Helen's confusion and paralysis when she realised the difficulty of establishing a true version of events as a journalism student. Olivia also went through a crisis when views she had held since childhood about her home country were challenged (see p. 114). She said:

> So, I shut myself down, and don't talk to anyone and I read books, like the Ted talks, some … psychological books … I still not gain any confidence, but after that I like, I started to know

> more about the economic - economics, and politics, in China [longer pause] but still I'm not good at persuasion, so [pause] so I question myself, a *lot*.

However, the journey from believing in one truth to considering differing perspectives and thence to making one's own judgements is arguably one that all critical thinkers must make, regardless of culture. According to Kuhn and Dean (2004, pp. 270 – 271), "pre-school children are realists", in that they perceive no difference between belief and reality. For children of this age, everyone necessarily has the same reality. Later in their development, when they discover that people can have different, sincerely held views of reality, they become absolutists; there may be different beliefs, but some are right, and some are wrong, and disagreements can be settled by referring to an external reality. Kuhn and Dean (2004) claim that adolescents, on realising that even experts disagree, start to value differing perspectives, but think they are all equally valid, in other words, they become multiplists. Boyes and Chandler (1992) argue that at this stage adolescents deal with the confusion and anxiety caused by the loss of their "previous sense of epistemic certainty" (p. 277) by other becoming either dogmatic about their own beliefs, or sceptical about all beliefs, recalling what some of my research participants said about critical thinking meaning questioning everything (see pp. 98-99). The final stage of development comes with "the hard-won realization that direct access to the unmitigated truth is not required for rational decision making" (p. 287). Kuhn and Dean (2004) point out that "[r]ather than facts or opinions, knowledge at this evaluative level of epistemological understanding consists of judgments, which require support in a framework of alternatives, evidence and argument". Note that I am by no means suggesting that my participants are immature or that or their cognitive development is somehow delayed. However, I think there are interesting parallels between psychologists' observations of the cognitive development of young people and what my participants said about their experience of becoming critical thinkers.

Whether this view of knowledge as certainty held by some participants is due to their culture, their stage of educational development, or something else, it is likely that they will have to develop a tolerance of ambiguity when studying in a university with a Western tradition of critical thinking, whatever their discipline (Claris and Riley, 2012; Davies and Barnett, 2015; Gupta and Ushur, 2012; Reid and Anderson, 2012). Arguably, a strong belief

in a single truth also makes being open-minded and genuinely respectful of others' viewpoints difficult; if the truth is fixed and indisputable, then only one version of it can be right. Reliance on an authoritative arbiter of the truth outside oneself also reduces the need for the independence of thought, as advocated by Facione's definition of critical thinking (1990). I asked my participants *what* they thought critical thinking was before the course, but I did not always ask them *why* they thought that. It would be an interesting research project to find out what concept EAP students, or indeed any higher education students, have of the nature of knowledge before they start their undergraduate or postgraduate degrees, and why they hold those perceptions, but this is outside the scope of this thesis.

5.4.3 The generalist approach

I chose to take a generalist approach (Davies, 2013, 2006; Ennis, 2015) for my critical thinking course because it was not possible to embed the factors I wanted to cover into a discipline specific content, as in the infusion or immersion approaches (Ennis, 1989). This appears to have been successful, at least for the students who stayed till the end and agreed to be interviewed. As discussed in this chapter and the previous one, the participants reported that their understanding of critical thinking had deepened and broadened, and this seems to be borne out by the analysis of the data. In addition, many participants said that they found the workshops interesting and engaging, and particularly enjoyed learning about the concepts behind critical thinking, such as confirmation bias, framing and cultural theory.

In the Literature Review, I noted that there is some evidence that awareness of one's own thinking processes, or metacognition, is a pre-condition for the development of critical thinking (Battersby and Bailin, 2013; Correia, 2016; Kahneman, 2011; Kenyon, 2014; Kuhn, 1999; Toplak et al., 2013). The participants themselves suggested indirectly that they might have thought so too. In my interviews I asked two questions that closely reflected my second and third research questions: first I asked if the participants had changed their perception of what "critical thinking" entailed in the light of my workshops, and secondly, if they had perceived any changes in their own thinking as a result of the course. As I reported in the Methodology chapter (p. 77), participants in all cohorts found it difficult to distinguish

between the two and would often talk about changes in their *own* thinking when answering the question about changes in their *concept* of critical thinking. These participants might have felt that that being aware of an aspect of critical thinking, e.g. framing, was tantamount to being able to incorporate it into their own thinking.

As noted in the Literature Review, critical thinking does not come easily to human beings, which is why it has to be taught (Kuhn and Dean, 2004; van Gelder, 2005). It involves System 2 thinking (Kahneman, 2011; Toplak et al., 2013) and conscious effort (Miele and Wigfield, 2014). "Strategic" metacognition is required to apply the appropriate critical thinking *skills* to a cognitive task to achieve one's goals (Efklides, 2008; Kuhn, 1999; Sadeghi et al., 2014). Metacognition, in the sense of awareness of how one's own mind works and an understanding of human thought processes in general, may also be necessary to the development of certain critical *dispositions*. This is what I hoped to achieve by directing the participants' focus to the psychological and sociological factors that affect human thought processes.

5.4.4 My workshops as part of the critical thinking process

I hope that my course has been helpful to my research participants on their critical thinking journey. There were only six workshops, so they could only have played a small part, but a few of the participants said they were more useful than the critical thinking instruction they had received at the ELTC or in their departments (see pp. 116 - 117). It is possible, however, that the workshops may not have come at the optimal time for all the students. I mentioned above the Saudi student who dropped out after not receiving the definitive right answer he asked for. Perhaps he was not ready to tolerate ambiguity just yet. The sample sizes were too small to draw definitive conclusions about any differences I noticed between cohorts, but in the Findings and Data Analysis chapter I sometimes speculated that they might have been linked to how long the students had been studying in the UK, or to whether they were already in their departments or still preparing to enter them. For example, I wondered whether the first cohort, who were mostly from the Pre-Sessional programme, reported a smaller impact in the area of "confirmation bias" because they may have had less experience in handling evidence (see p. 106).

I also speculated that the May start cohort, who were the furthest advanced in their studies in the UK, had reported a bigger impact on "argument building" because they were able to apply what they had learned in the workshops about sources, confirmation bias and framing to essay writing and seminar discussions on their degree courses (see p. 103). On the other hand, perhaps Helen, who was in this cohort, might have benefitted from exploring why people can have different views of the same evidence much earlier in her journey, when her Chinese friends dismissed BBC interviews with Uyghur re-education camp detainees as propaganda (see p. 125). Olivia might have found the workshops a useful support earlier still; her crisis of confidence occurred when she was an undergraduate studying in the UK (see pp. 160 - 161 of this chapter). As noted in the Findings and Data Analysis chapter (p. 113), the course had a much greater effect on some participants' sense of themselves as independent thinkers than on others, but I do not know why. So, another potential area of future research might be at what point in the higher education student's journey this kind of intervention is most helpful.

5.5 The participants' perceptions of climate change

As noted in the Findings and Data Analysis chapter, the impact of the workshops on participants' attitudes to climate change was somewhat less noticeable than the impact on their perceptions regarding critical thinking. However, one unexpected discovery (for me) was that many of the participants thought that concern about climate change was the mainstream or dominant view, in other words, that most people were worried about it (or thought they should be). Much of the literature about the psychology of climate change suggests that the issue does not preoccupy most people very much, either cognitively or emotionally. As noted in the Literature Review, Kahneman (2011) argues that this is because the issue appears to be "abstract, distant, invisible and disputed" (interviewed in Marshall, 2014, pp. 56-57), and individuals see climate change risks as geographically remote or far in the future (APA, 2011). In addition, many people see climate change as the special interest of some other group or type of person, rather than an issue of universal concern (APA, 2011) or personal relevance (Marshall, 2014). These attitudes were displayed by some of the participants both before and after the course.

However, as noted in the Literature Review (see p. 35), much of the research into attitudes to climate change published in English has been conducted in Western countries (APA, 2011), not in China or Taiwan where most of my participants are from. Unlike the media in most Western countries (Pigeon, 2012), the state-controlled Chinese media presents "an unambiguous view of climate change risks" with no scepticism (Reporters Without Borders, 2020), and Chinese people appear to trust that their government is dealing effectively with the problem (Schwirplies, 2018). Some participants seemed to entertain new doubts about the seriousness or reality of climate change after being exposed to different views about it. However, the Chinese participants knew that their government takes the issue seriously and expects them to do so also. In this sense, concern about climate change is arguably an orthodox stance in China. In general, Taiwanese people do not seem to trust their government over their handling of climate change as much as the Chinese trust theirs (Chou 2013), but public concern over the issue is high (Chou, 2013; Sun and Han, 2018), so it does not appear to be a minority interest there either.

When I began planning my research in 2015, climate change did not seem to be a mainstream concern, at least in Europe and the US (Pew Research Centre, 2015). As discussed in the Findings and Data Analysis chapter, the participants identified many reasons why the issue was not more salient in public and interpersonal discourse, such as the distancing effect (Kahneman, 2011), tribalism and in-group influences (Marshall, 2014), denial, paralysis or apathy (APA, 2011, p. 43), and socially constructed silence or selective attention (Norgaard, 2009). However, recently, the profile of this issue has increased considerably, particularly in 2019, when I conducted my workshops. This was, for example, the year that activists from the environmental pressure group Extinction Rebellion were taking direct action to raise awareness of the urgency of climate change in the UK and many other countries (BBC, 2019a), and that Greta Thunberg's "School Strike for Climate" movement spread around the world (Watts, 2019).

So it is possible that climate change is no longer an "elephant in the room", as claimed by Marshall (2014) and Norgaard (2009). The website of the American Psychological Society (APA), whose 2011 report into the psychological issues surrounding climate change has been such a useful resource in this thesis, now notes that "[c]oncerns about climate change have grown into a full-fledged social movement, spurring climate activism worldwide and

opening opportunities for virtually every discipline to address the crisis" (APA, 2020). The Pew Research Center finds that "[c]oncerns about climate change have risen significantly in many countries since 2013" (2019). So perhaps the taboo against talking about climate change has, in some contexts at least, switched to a taboo against not appearing to care about it, as Olivia suggested (p. 138). If so, this is the background against which participants who have been encouraged to think independently, resist social pressure and question their own assumptions, and who have discovered, possibly for the first time, that there are widely differing views of climate change, are reconsidering the now conventional belief that is a serious problem caused by human activity.

Naturally, as a climate change activist, I hope that these participants will maintain their interest in this issue, continue to apply their critical thinking skills and information-oriented dispositions to the evidence relating to climate change, and eventually come back to their original position of their own accord. Or they may not: as noted in the Findings and Data Analysis chapter, during the workshops participants displayed some of the common attitudes which hinder engagement with climate change, as described in the Literature Review (pp. 32-37). On the other hand, Workshop 5 highlighted the gap between the level of risk posed by climate change as suggested by the scientific evidence, and the (low) feeling of risk the students said they and their families and friends experienced. Some of the students who attended this workshop identified the psychological factors causing the gap, such as future discounting, optimism, availability bias and the bystander effect. If awareness of one's own thinking processes is necessary for avoiding critical thinking pitfalls, these participants may also become aware of their own barriers to acknowledging or acting on "the defining issue of our time" (UN, 2020).

Another interesting discovery was that although the students at the workshops displayed a range of attitudes to climate change that was familiar to me, they seemed unaware of the guilt that characterises much of the response to climate change in the UK, Europe and the US (APA, 2011; Norgaard, 2009). For instance, in Workshop 4, to illustrate the concept of socially constructed silence to my class of mostly Chinese and Saudi students, I used the example of cognitive dissonance experienced by Norwegians caused by the conflict between their identity as climate-aware nature-lovers and their shared ownership of the country's vast oil wealth, as researched by Norgaard (2006). However, most of the students did not

seem to understand why Norwegians should feel conflicted. (The Saudi economy is, of course, dependent on *its* vast oil wealth, but this probably does not threaten their sense of identity). In Workshop 5 in the May start course, some of the Chinese students suggested that their government directed its citizens to take the appropriate action to tackle climate change, so they did not have to take personal responsibility, or even know the reason for taking such action. It is perhaps significant that, as noted in the Findings and Data Analysis chapter (p. 137), some students in Workshop 1 thought that personal actions that were easy but made virtually no difference to carbon emissions (such as switching to energy-saving lightbulbs) were worth taking, whereas at least two participants thought that lifestyle changes that might make a more significant impact (such as reducing mobile phone use) would entail unreasonable sacrifices. These experiences made me think that perhaps climate guilt, in the sense of taking personal responsibility for the problem, is a Western phenomenon.

This may be in part because China and Saudi Arabia are autocratic regimes. In Western democracies such as the United Kingdom, citizens expect to be able to influence government policy on issues that matter to them, not only through the ballot box or their Member of Parliament, but also though campaigning strategies such as petitions and public protests (BBC, 2020c). Climate change in the UK, for example, has only recently made it onto the mainstream political agenda, thanks largely to the efforts of activists (House of Commons Library, 2020). Citizens in authoritarian states such as China do not have the option of lobbying their governments, but they also may simply trust the authorities to deal with the problem (Schwirplies, 2018). Alternatively, they may see taking personal action on climate change as making lifestyle changes as described above, rather than calling on their government to implement certain policies. Citizens of a democracy, on the other hand, arguably share responsibility for their government's level of action on climate change, manifested in the Norwegian participants of Norgaard's study (2006) by the kind of civic guilt that my own participants did not seem to share.

The students also seemed to be unaware of how climate change has become politicised in the West, for instance, in Workshop 4, where I attempted to use the example of the American right-wing group the Tea Party to demonstrate how climate change denial can be fed by group identity. Perhaps this is because before the course they did not know that

there were so many different views of the issue, as discussed in the Findings and Data Analysis chapter (pp. 140-141). It may also be because in non-democratic countries, belief in or concern about climate change is not necessarily a matter of opinion or of political identity, as in the West, for the reasons expressed above.

These observations alerted me to the assumption I had made, that students from the Far East or Middle East would necessarily feel the same way about climate change as Western people might. For this reason, and because attitudes to climate change are shifting as discussed above, it proved to be a sensible and effective strategy to use of a variety of topics alongside climate change to illustrate the concepts I wished to explore in the workshops, particularly the influence of culture, in-groups and peer pressure.

In the conclusion I will summarise my main findings and reflections on these, the contribution I believe my study has made to the field of education, and its implications for EAP practice.

6. Conclusion

6.1 Introduction

In this concluding chapter I will summarise my thesis, outline the contribution that this research project makes to the field of EAP and its implications for practice, discuss the study's limitations and suggest how these might be addressed by future research. I will also review my motivations for embarking on my research and describe the impact of the process on my personal learning and development.

6.2 Thesis summary

In the Literature Review, I discussed some definitions of critical thinking, and its place in higher education and in EAP teaching. Three models of critical thinking; the "skills-and-judgments" view, the "skills-plus-dispositions" view, and the "criticality" view (Davies and Barnett, 2015) were outlined. I also gave my own categorisation of critical dispositions; those relating to information or ideas; those relating to the self; and those relating to other people. The role of EAP teachers in developing critical thinking, both in the "pragmatic" (Dudley-Evans, in Benesch, 2001) and "critical" EAP traditions (Benesch, 2001; Pennycook, 1997; Phillipson, 1992) was examined. The idea that critical thinking is a Western concept was discussed and problematized (Bali, 2015; Lugli, 2015; Ryan and Louie, 2013; Vaidya; 2017). I also described some of the methods by which EAP teachers (e.g. Codita, 2016; Tanaka and Gilliland, 2016; Thompson, 2002; Wilson, 2016), and academics (e.g. Ahern et al., 2012; Claris and Riley, 2012; Drennan, 2010; Jones, 2007 and 2015) try to foster critical thinking skills and dispositions, and criticality, in their students.

As I explained in the Introduction chapter, my research was inspired by my frustration that climate change has generally not been treated with the urgency and seriousness required to avoid catastrophe (APA, 2011; Marshall, 2014; Norgaard, 2009; Pigeon 2012), and my curiosity as to why this might be. This led me to explore some of the psychological and sociological factors thought to affect attitudes to climate change (APA, 2011; Norgaard, 2009) and all human thinking (Evans, 2010; Kahneman, 2011; Marshall, 2014), and which are

particularly relevant to critical thinking, as outlined in my Literature Review. These are confirmation and belief bias (Kahneman, 2011), framing (Toplak et al., 2013), the influence of culture and in-groups (Norgaard, 2009; Rabinovich et al., 2012), and flaws in the assessment of probability and risk (Evans, 2010; Kahneman, 2011). Research suggests that teaching about such factors can help students to avoid critical thinking pitfalls (Battersby and Bailin, 2013; Croskerry, 2014; Kenyon, 2014; Maynes, 2017; Royce et al., 2019; van Gelder, 2005), although none of these studies involved EAP students. My project was motivated by a wish to fill this gap, and to bring together four areas of interest to me which overlap in places: EAP, critical thinking, psychological factors that affect thinking, and attitudes to climate change. I decided to attempt to fill the research gap by exploring the psychological and sociological factors which affect critical thinking with EAP students using climate change, to see if they perceived an impact on their critical thinking. My research questions, therefore, were:

1. What do EAP students understand by “critical thinking”?
2. Does exploring psychological and sociological factors which influence human thinking in workshops affect students' perceptions of what constitutes critical thinking? If so, how?
3. Do students feel that exploring these factors in workshops has an impact on their own critical thinking, and if so, how?
4. Does using the topic of climate change in such workshops change students' perceptions of the issue, and if so, how?

My Methodology chapter outlined my positionality as EAP teacher and climate activist, justified my choice of interpretivist epistemology and the methods I used, and explained how I ensured trustworthiness. I then described my methods for generating and analysing my data, which were: a series of workshops exploring five factors or areas influencing critical thinking with EAP students; interviews of participants and some observational notes to generate the data; and thematic analysis and code development (Boyatzis, 1998; Braun and Clarke, 2006; Cohen et al., 2011; Wellington, 2015) for the analysis. I finished with a discussion of ethical issues arising from the project and how I addressed them.

In the Findings and Data Analysis chapter, I explained how I used the findings to answer my four research questions. In answer to my first question, I concluded that before the course, the participants thought that questioning and analysing, multiple perspectives, and argument building were central concepts in critical thinking. After the workshops, they added confirmation bias, the use of evidence and sources, framing, independence and initiative, and the influence of culture, so answering my second research question. Participants reported an impact on their own thinking in the areas of confirmation bias, multiple perspectives, respect for others' views, self-awareness and the use of evidence and sources. They also reported that the workshops deepened their understanding of critical thinking. This answered my third research question. There was less impact on participants' attitudes to climate change, the focus of my fourth research question, than on their critical thinking; this is discussed in more detail below,

In the Discussion chapter, I speculated, with reference to the literature on developing critical thinking, that participants felt that the workshops helped them to better apply the skills they had valued before the course: they seem to have acquired some useful tools for questioning and analysis, and they may also have gained a better understanding of multiple perspectives and argument building. They also appear to have expanded their concept of critical thinking to include dispositions which help them to understand their own thought processes, such as self-awareness, and those of other people, such as respect for others' views. The vast majority reported that they had a deeper understanding of critical thinking, and more than a quarter of the participants said, unprompted, that they found my approach more helpful for their critical thinking development than their EAP or degree programmes.

The workshops appear to have had less impact on the participants' perceptions of climate change than on critical thinking. Although climate concern was high before and after the course, participants displayed a range of attitudes indicating detachment from the problem which are well documented by research (APA, 2011; Marshall, 2014; Norgaard, 2009). However, an unexpectedly high number considered climate change to be a mainstream rather than a niche concern. They also seemed to lack the climate guilt common in the West (APA, 2011; Norgaard, 2009). Several participants reported a new awareness of differing views of climate change, such as denial; this prompted a few of them to reconsider their assumptions that it was real and man-made.

6.3 The contribution of my research

My research participants reported that exploring the psychological and sociological factors that affect human thought processes helped them to develop their critical thinking skills and dispositions in a way they found engaging and useful. Thus, they perceived an improvement in their critical thinking even though this exploration did not specifically focus on academic-style tasks as is usual in critical thinking development for EAP (Moore, 2019), and was not tailored to the particular requirements of participants' disciplines (Dudley-Evans, in Benesch, 2001). As explained in the Literature Review, my approach could be described as "generalist" (Davies, 2013; Ennis, 2015), because it focused on critical thinking in isolation from the participants' disciplines, or "infusion" (Ennis, 1989); because they were also practising and improving their language skills. In either case, my research suggests that EAP teachers do not have to take a purely instrumental approach to critical thinking, in which skills are immediately applicable to their assignments and assessments. It also shows that EAP teachers do not need formal training in psychology or sociology to lead this exploration of factors affecting critical thinking; I do not, and students reported significant benefits from my workshops. In fact, in my experience EAP practitioners often successfully undertake work that stretches their supposed knowledge and remit as language teachers, for example when asked to teach science and engineering students how to read and write texts in a discipline the teachers know almost nothing about.

In my Methodology chapter (p. 44) I suggested that EAP teachers and students might be forgiven for taking a pragmatic view of critical thinking as a set of skills that must be displayed to pass a degree course. Yet critical thinking for display only is surely a sterile exercise. Critical thinking that does not require students to reflect on their own beliefs and attitudes does not fulfil the purpose of education, even by universities' own "graduate attribute" standards (see, for example, the University of Sheffield, 2020). Education and critical thinking should have the potential to both change students (Bleicher, 2006; Rohstock, 2012) and to equip them to become "active agents of social good" (Howe, 2016). This requires the fostering of dispositions and criticality as well as skills. If students cultivate dispositions that allow them to better understand themselves, they may be able to avoid critical thinking pitfalls, such as belief or confirmation bias and socio-centric attitudes. If they cultivate dispositions that allow them to better understand other people, they can

develop empathy and bridge-building skills necessary to solve modern problems (Howe, 2016), especially where these are caused by the polarisation of opinion, as mentioned in the Introduction chapter. Robin's wish to examine "the debate between sceptic and protector" and to explore "why … they have different opinions and try to listen to different people's thoughts about climate change" is an encouraging step in this direction (see p. 140). EAP teachers can and should be part of this development.

6.4 Impact on my personal learning and development

At the beginning of my research programme, I imagined that my workshops would "educate" students about why they should take climate change seriously, assuming that they would be subject to the psychological and sociological barriers to concern about the issue described in this thesis (see pp. 32-35). The picture that emerged from the data was more complicated, as discussed above. I now realise that I was really trying to encourage students to try and understand themselves and other people, and to listen to them. I wanted students to have a deeper and less instrumental engagement with critical thinking than is usual in EAP, and I seem to have achieved this with most participants.

Before I embarked on my doctoral studies, I took a pragmatic view of my role as an EAP practitioner, i.e. that I was paid to help students acquire the skills they needed to be successful in their future studies and so serve their academic departments too. This is because I am a generally conscientious person who wants to fulfil her responsibilities and be useful to others. However, I also wanted to fulfil my responsibility as a human being and global citizen by raising students' awareness of climate change, which meant also engaging students critically. This has led me to rethink my role as EAP teacher and pushed me to articulate (to myself) my belief that EAP teachers are more than language technicians, whether this is acknowledged or not, as discussed below.

6.5 Implications for practice and policy

I suspect that some teachers of EAP, and their managers and employers, would argue that the kind of critical thinking teaching I undertook in this study was beyond my professional

remit. My study considers the role of the EAP teacher as part of students' wider education, rather than as simply a language technician in "a peripheral and marginal service role" (Ding, 2019) who fixes the students' English so they can succeed in their "real" studies. EAP practitioners are often their students' first point of contact with the academic culture of the host country, and on pre-sessional courses they may be the only university teachers they encounter for many months. EAP teachers focus on critical thinking in some form as part of the development of academic skills such as those required in essay writing, seminar discussions and presentations (Moore, 2019). Improving their critical thinking even at this instrumental level surely contributes to the students' intellectual development. So EAP practitioners do indeed contribute to the students' overall education.

However, EAP teachers like me hold a somewhat ambivalent position in the field of higher education (Ding and Bruce, 2017). Although practitioners who have crossed over from mainstream teaching may have the UK's Postgraduate Certificate in Education (PGCE) or equivalent, many others do not have a specific educational qualification beyond general English Language Teaching qualifications such as the Certificate in English Language Teaching to Adults (CELTA), which can be acquired after a four-week intensive course, or the DELTA, a diploma level qualification (Ding, 2019). Courses for these qualifications do not go into educational theory in much depth, so these practitioners may not feel that they have a role in their students' intellectual development beyond teaching them useful language skills. In addition, EAP teachers in universities are often regarded as providing a support service, so although EAP has become an academic field in its own right (Ding and Bruce, 2017), practitioners do not in fact enjoy the status of academics (Ding, 2019). Moreover, many EAP teachers are in precarious employment (Ding, 2019). It would not be surprising then if EAP teachers lacked belief in their role as educators, or confidence in asserting this with their own managers or the academics whose students they support. At my own institution, for example, in-sessional EAP teachers are expected to closely tailor their lessons to their students' degree programmes, but often find it difficult to obtain assignment details or reading lists from academics who are busy setting up these programmes. The status of EAP practitioners is relatively low considering their accomplishments, flexibility and utility to departments in enabling them to recruit and retain the international students on which the viability of their courses may depend.

EAP practitioners should realise that they are, and have always been, part of their students' education and personal development as they guide them on their critical thinking journey. EAP provision allows universities to base their business model on income from international students. But if education becomes just another commodity (Coate, 2009; Lomer, 2016; Naidoo et al., 2011), then students might see the display of critical thinking as merely a hoop to jump through in order to gain the qualification they have paid for, to the detriment of the development of their dispositions and criticality. Students would benefit if their EAP teachers could show them, particularly on pre-sessional programmes, that critical thinking is more than this, and that it can enrich their lives outside as well as within their studies.

In terms of teaching practice, I hope that EAP professionals reading about this study will find the application of research from psychology and sociology to critical thinking thought-provoking. They may wish to consider whether focusing exclusively on critical thinking skills directly relevant to academic tasks, while necessary, is sufficient for their students' critical development. They may also be inspired to include broader and deeper exploration of critical thinking in their own lessons. In English for Specific Academic Purposes, the sessions could be tailored to the students' discipline by using apposite case studies and examples.

In terms of policy, managers and staff involved in teacher development could encourage EAP teachers to read more widely about education psychology, including the factors affecting critical thinking in this study, and not to focus exclusively on books and articles that take a pragmatic approach to EAP. Similarly, qualifications in Teaching English for Academic Purposes could include modules which explore critical thinking in more depth than they currently do.

6.6 Limitations

My study necessarily had some limitations. To comply with the conditions of my ethical approval, my sample was self-selecting; and to ensure I had enough participants, I opened my study to all EAP students at the ELTC regardless of programme, nationality, discipline or first language. I would like to have made a more careful comparison of the effect of the course on EAP students according to type, for example pre-sessional versus in-sessional; or nationality, for example Chinese versus Saudi; or discipline area; for example humanities,

arts and social sciences versus science, technology, engineering and maths. However, there would have been no guarantee of filling the classes if I had restricted each course to any one type of EAP student. Another limitation is that few students came to all the workshops, which may have affected the reliability of my findings and conclusions. However, I appreciated that busy students were likely to be put off joining the project if I insisted that they attend every workshop, even if the conditions of my ethical approval had allowed this.

If I were to run this project again, I would take more details of participants' previous experience of learning about critical thinking, for example how long, in what setting, and using what approach, as well as establishing when they started studying in the UK. This would have aided my speculations about the differences between individual participants and between the three cohorts. However, I originally planned to do only one main course over the summer programme, so did not expect to be comparing students with such widely differing experiences of studying in Britain.

Another limitation in my study was the potential for conflict between my dual roles as teacher and researcher. As I explained in the Methodology chapter (see p. 50), there was a danger that the relationship established in the classroom between the teacher/researcher and the students/participants would inhibit the latter from expressing their thoughts and feelings honestly at interview, for fear of offence. This issue might have been addressed by asking someone else to interview the participants, but I thought this inappropriate for a lone researcher working towards a doctorate. In any case the participants would know that the interviewer and teacher were going to confer.

I acknowledge that it is impossible to know for sure whether and how this teacher-student relationship may have influenced the interviewees responses. However, I attempted to mitigate this effect in a number of ways. Firstly I worked to create a supportive and mutually respectful class atmosphere in which students felt they could freely express their views, in front of me and the other students; comments from participants suggest that I achieved this (see p. 90). I hoped that if students found me to be open-minded and non-judgemental about their views as a teacher, they would expect the same from me as an interviewer and feel they could be frank in their responses. Secondly, I used interview techniques intended to avoid leading the students into giving answers they thought I might want. For example, in one-to-one interviews I asked open questions and patiently elicited

answers without prompting or leading them (see p. 59). In group interviews I displayed the interview questions on the interactive whiteboard and withdrew into the background so that participants could conduct the conversation amongst themselves, as they had done in small group discussions in class (see pp. 76 - 77).

There is evidence from several of the interviews that these methods to reduce my influence over participant responses were successful. Some participants freely admitted that despite attending several of my workshops, they still found critical thinking an elusive or difficult concept, for example Olivia (see p. 118) and Cyan (see p. 119). The participants must have been in no doubt by the end of the course that I cared deeply about climate change and thought urgent action was needed. However at interview, Olivia admitted that she did not care about climate change (see p. 135), Yaling and Abda argued that avoiding high-emission activities might lead to unreasonable restrictions on their lifestyles (see p. 136), and Helen thought that my course made her reconsider her previous assumption that climate change was anthropogenic (see p. 113). These examples show that in some cases at least, participants' responses were unlikely to have been led by what they thought I wished to hear.

6.7 Recommendations for further research

Future research could compare the effects of exploring factors influencing critical thinking on EAP students from different programmes, countries or disciplines, as described above. As explained in the Methodology chapter and in "Limitations" above, my sample was of necessity limited almost entirely to students whose first language was not English; an exploration of the relationship between first language and critical thinking is in any case beyond the scope of this thesis. So other studies might compare students for whom English is their first language, as these may benefit from EAP provision (Northcott, 2019), and those for whom it is a second or other language. It would also be interesting to discover what concept EAP students have of the nature of knowledge (for example as immutable and certain, or as dependent on perspective) before they start their undergraduate or postgraduate degrees, and why they hold those perceptions. Finally, a critical thinking course like mine could be run for students at different points in their student journey, for

example as they join a pre-sessional programme, as they finish one, or at various points in their degree programmes, and participants interviewed to compare what benefits, if any, they gain from the programme.

6.8 Final thoughts

We need critical thinking now more than ever. Humans have evolved to think flexibly in two contrasting ways, mostly intuitively but reflectively when required, and this has helped our species survive and flourish (Evans, 2010). Indeed, so successful have we become in manipulating and changing our environment to suit our immediate needs, that in the longer term we risk a number of ecological catastrophes, including (but not confined to) climate change. Solving these and other global problems requires us to rely more heavily on our reflective thinking, that is, our ability to think critically, than on the intuitive mode that perhaps comes more naturally to us. Universities as institutions at the highest level of research and education should take the lead in this. EAP teachers, standing as they do outside the constraints of individual academic disciplines, are in a unique position to deliver the kind of general, but deep, insights into the human factors that affect our thought processes and so help students of any background to become better critical thinkers.

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Appendix 1

The cognitive bias codex

This diagram is from Wikipedia Commons (n.d.) (see also the References):
https://commons.wikimedia.org/wiki/File:Cognitive_bias_codex_en.svg

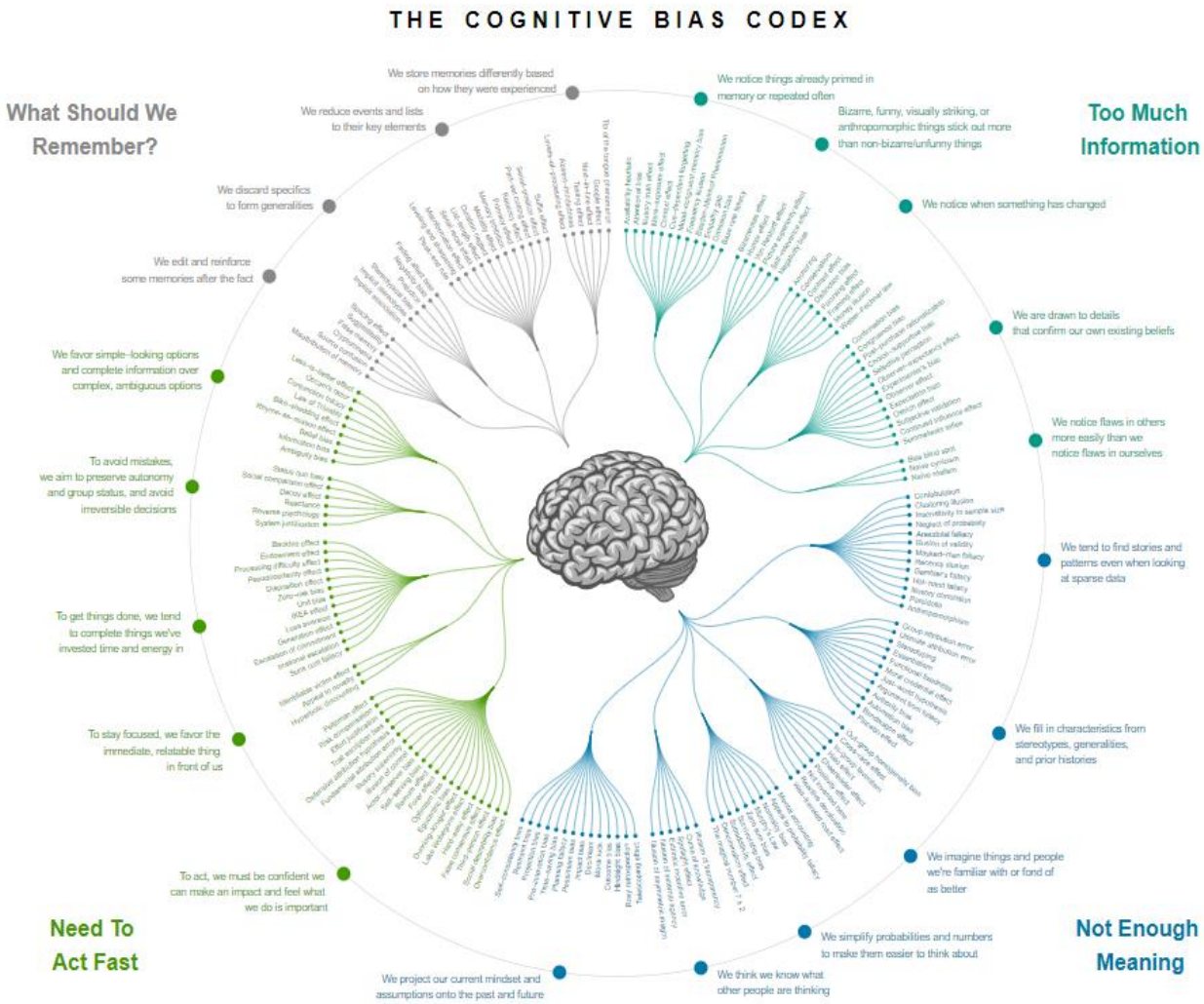
The diagram from the link above is also reproduced on the following page. It is a visual representation of 188 common biases relating to: beliefs, decision-making and behaviour; social relations; and memory.

Some of the biases in the codex are covered by the workshops. For example:

> Workshop 1: belief bias (upper left segment of the diagram, between 9 and 10 o'clock)
>
> Workshop 2: confirmation bias (upper right segment, at 2 o'clock)
>
> Workshop 3: framing effects (upper right segment, between 1 and 2 o'clock)
>
> Workshop 4: stereotyping (at 4 o'clock), out-group homogeneity bias (at 5 o'clock), in-group bias (at 5 o'clock)
>
> Workshop 5: availability bias (top of diagram, at 12 o'clock), neglect of probability (at 3 o'clock), gambler's fallacy (at 3 o'clock), optimism bias (at 7 o'clock), loss aversion (between 8 and 9 o'clock)
>
> (Workshop 6 was a review session)

Workshops 3 and 4 covered areas of social psychology and cultural theory which are not specifically referred to in the codex. Workshop 5 also covered biases relating to risk and probability that are not in the codex, for example the bystander effect and future discounting. Please see the commentaries on these workshops in Appendix 2 for details.

The cognitive bias codex



Appendix 2

Commentaries on the workshops

Below is a commentary on key stages of each workshop where I thought it would be helpful to the reader to explain my thinking, or the theoretical background, behind certain materials or activities. (So these commentaries do not cover every stage of every workshop). The workshops underwent minor revisions between courses; the commentaries refer to the final, October versions. Please see Appendix 3 for details of these changes, and the thesis reference list for the full details of the sources.

Workshop 1: "Source reliability"

Workshop 1 focuses on the reliability of sources. Students are encouraged to give credence to reliable sources and the evidence they use even if the students do not like the sources' findings or find them counterintuitive. The workshop should also demonstrate that even reliable sources may disagree and that students must use their own judgement about whom to believe, based on the criteria below. In terms of psychology, the focus of the workshop is connected to belief bias and confirmation bias; in terms of critical thinking in education, it relates to having an evidence base, recognising bias (both Jones 2015) and evaluating the evidence for alternative points of view (Cottrell, 2011).

The workshop highlights the importance of checking one's sources to see if they have:

1. Authority: Where did the student find this source? Is it academic, or does it come from some other reputable source? Has the student heard of this institution? Who are these people and what are their qualifications? What evidence do they have for their position?

   It is worth noting that:

   - What "authorities" say often has to be taken on trust by those who are not experts in the field. The question then is, does one trust them?

- This is what peer reviewed journals are for – experts judge each other. If an article has been through the peer review process, it is probably trustworthy to some extent (but see below).
- There is a difference between reporting "facts" or presenting "evidence" and drawing conclusions or forming opinions based on them.

2. Independence: e.g. Does the organisation disclose its funding sources? Does any other organisation, e.g. a government, have power or influence over them? Are they partisan, i.e., "A strong supporter of a party, cause, or person" (Lexico, 2020).

It is worth noting that

- Even if the source is partisan, this does not necessarily mean the evidence is worthless. However, the source may display bias in the way evidence is included or excluded in order to make a case – this will be covered in more detail in later sessions.

3. Opposition from other "good" (authoritative, independent) sources.

It is worth noting that:

- Authoritative sources often disagree, and this is part of the academic culture of debate in the UK and other countries.
- Students will become part of this debating culture, for example in their essays and in seminars, when they should be ready to defend their positions with strong arguments based on evidence.

References for "authority", "independence" and "opposition" (see also the References):

University of Edinburgh: https://.ed.ac.uk/information-services/library-museum-gallery/finding-resources/library-databases/databases-overview/evaluating-websites

University of Hull: https://canvas.hull.ac.uk/courses/611/pages/determining-source-reliability

University of Maryland: http://sites.umuc.edu/library/libhow/credibility.cfm

The quiz

The quiz questions highlight different aspects of assessing sources (see below) and discussing the answers should prompt students to consider why they believe what they do.

For the answers, it is of course impossible to give the students all the sources that support a certain view. Mostly I have chosen sources that are credible by the definition I have used in this workshop, e.g. academics or institutions with relevant expertise, peer-reviewed academic journals, or mainstream media sources that contain links to academic studies that can be followed up. I have also tried to choose sources that would be expected to at least attempt to avoid bias (while acknowledging that some bias is inevitable); for example, I chose broadsheet rather than tabloid newspapers.

However, for some of the quiz answers I have chosen sources that do not necessarily fulfil these criteria. For example, I have chosen the Norwegian State Oil company Equinor (formerly Statoil) and the #Keep It In The Ground campaign as examples of obvious partisanship for the question of whether fossil fuel use is incompatible with tackling climate change, and the Heartland Institute, which has historically been funded by oil companies, to show how sources of funding might lead to or reflect bias (Abraham, 2016).

Question 0: (on the presentation slide)

In December 2015, all the nations met in Paris and made an agreement to cut emissions to slow down global warming. What did they agree should be the maximum rise in temperature (since pre-industrial times)?

a) 2^{o} C *b) 4^{o} C* *c) 6^{o} C*

This is a "warm-up" question, and unlike most of the questions in the quiz, it has a single "correct" answer, "a", based on a recent, well-recorded event which is easily verifiable. This question also sets the scene for Question 3, as it establishes that even quite small variations in average global temperature are considered to be significant. The source of the correct answer is the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC, 2020).

Question 1: *Scientists disagree about whether climate change is a result of human activity or natural causes.*

True or False?

This question focuses on the reputation of the source. The answer "True" is supported by the United States' National Aeronautics and Space Administration (NASA, 2020), and the answer "False" is supported by the Heartlands Institute (2014). Students will probably have heard of NASA and consider it to be a highly reliable source of scientific information; they are far less likely to have heard of the Heartland Institute, although out of all the sources I have found that questioned this consensus, I feel this source looks the most credible. It appears frequently in internet searches for climate sceptical views, and is a large, wealthy and influential organisation which, according to its website, employs "some 500 academics and professional economists" (Heartland Institute, 2020a) and "has organized and hosted 12 International Conferences on Climate Change (ICCC) since 2008" (Heartlands Institute, 2020b). Its credibility is weakened, however, by the fact that it now does not disclose its funding, but previously admitted it was funded by the fossil fuel industry.

This question is also another example of the difficulty of finding a credible source, or one that looks credible, which contradicts the scientific consensus that climate change is mostly anthropogenic. However, up until recently there has been a common misconception that there is significant disagreement amongst scientists over this issue (Pigeon, 2012), so like Question 6 it is intended to prompt students to question popular beliefs.

Question 2: *If we don't cut our emissions, how much will the temperature rise by 2100?*

a) 2^{o} C or less *b) about 4^{o} C* *c) about 6^{o} C*

Answer "a" is supported by *Investor's Business Daily* (2020) citing an article from the Journal of Climate. Answer "b" is supported by the Fifth Assessment Report from the UN's Intergovernmental Panel on Climate Change (IPCC, 2014b). Answer "c" is supported by The Earth League, an alliance of scientists from research institutions around the world (Connor, 2015). This demonstrates that three creditable sources can give three different answers to the same question. In fact, most of the answers to the quiz could be seen as a matter of

opinion, although the protagonists in these debates might argue that they are matters of fact and quote figures and data to support their views.

The view that predictions of global warming made by the vast majority of scientists, such as those on the IPCC, are exaggerated is by definition a marginal one. In fact, it is hard to find a credible source to support the idea that the world is *not* heading for significant temperature rises under a "business as usual" scenario, and that by extension that there is *no* need for radical cuts in emissions. When preparing these workshops, I googled "global warming predictions are exaggerated" and looked at the first 10 results, and I found: two right-wing newspapers that quoted a study which the authors themselves said had been misinterpreted; a website and a centre-left paper that reported this misinterpretation; opinion pieces from USA today, the *Herald Sun* (an Australian paper), two business publications and a free-market blog (of which five pieces none of the authors were scientists); and an opinion piece from a scientist from 1990. I chose the *Investor's Business Daily* as appearing to be the most credible of these results. I also felt that this internet search provided a useful illustration of how scientists find their studies are sometimes misinterpreted by the media.

Question 3: *Fill the gap with one of the figures below. "If the average global temperature rises to _____degrees Celsius, humans won't be able to adapt, and some scientists say this will mean the end of civilisation".*

a) 4 *b) 6* *c) 8*

This question is intended to demonstrate that claims that seem counter-intuitive, such as the claim that an apparently small rise of 4° Celsius would have devastating effects on humanity, can be supported by evidence from reliable sources such as the IPCC (UNFCCC, 2015), or experienced climate scientists such as Professor Lonnie Thompson (2010).

Question 4: *By how much do we need to cut our net global emissions by 2040 to keep the temperature to 2 degrees or below?*

a) up to 20 % *b) 50 - 60%* *c) 90 - 100%*

Answer "a" is supported by *Investor's Business Daily* (2020) citing an article from the Journal of Climate. Answer "b" is supported by the European Commission (n.d.). Answer "c" is

supported by a paper published in the journal *Nature* (Walsh et al., 2017), which was itself cited in a report in the *Independent* newspaper (Johnston, 2017).

This question, like Question 2, is meant to show that three credible sources can give three different answers to the same question. The students will be encouraged to consider later in the lesson the possible differences in standpoint between types of source; in this case we have a business magazine, a political body and an academic journal. It is worth noting also, as in Question 2, that predictions, even when based on reliable data, are always to some extent a matter of opinion.

Question 5: *To solve the problem of climate change, the use of fossil fuel (i.e. oil, gas and coal) must end as soon as possible.*

True or False?

The answer "True" is supported by the climatologist Jeff Tollefson (2018), writing in the journal *Nature*, and by the grassroots campaigning group KeepItInTheGround (2016). The answer "False" is supported by the *UN Chronicle*, the United Nations' in-house magazine (Foster and Elzinga, n.d.) and by Statoil (now Equinor), Norway's state oil company (Statoil, 2017). This question demonstrates that on some issues, such as how to transition to a greener economy, expert opinion is somewhat more evenly divided than it is over predicted temperature rises or the percentage by which emissions should be cut. However, students should consider the likely standpoints (and therefore possible biases) of the sources on each side, for example those of the Keep It In The Ground campaign as opposed to the oil company Statoil/Equinor.

Question 6: *These are all good ways to cut personal carbon emissions: always turn off unused lights, never drink bottled water and never use a new plastic bag.*

True or False?

This question is intended to make students question popular beliefs, in this case about behaviours which may be (erroneously) linked to the reduction of carbon emissions. The handout giving the sources to the answers quotes the book on the carbon footprints of common goods and services by Mike Berners-Lee (2010):

- Using 5 plastic bags a week for a year = 2.5 kg of greenhouse gas emissions (p. 18)

- Drinking one plastic bottle of water per day for a year = 58.4 kg (p. 43)
- Leaving 1 low-energy lightbulb on for a year = 90 kg (p. 100)
- Leaving 1 incandescent lightbulb on for a year = 500 kg (p. 100)

Compare:

- One cheeseburger a day for a year = 910kg (p. 86)
- Using your mobile phone for one hour per day for a year = 1,250 kg (p. 113)
- One economy class flight from London to Hong Kong = 3,400 kg (3.4 tonnes) (p. 135)

Berners-Lee, M. (2010). *How bad are bananas?* London: Profile Books Ltd.

Workshop 2: "Confirmation bias"

Confirmation bias is relevant to critical thinking in higher education because it affects the collection and evaluation of evidence and hypothesis testing, and impairs one's ability to appreciate other perspectives (Evans, 2010), with implications for the critical disposition of open-mindedness (Davies and Barnett, 2015; Facione, 1990; Thompson, 2002). Resistance to this bias is known as "otherside thinking" (Toplak et al, 2013, p. 1041) or "the outside view" (Kahneman, 2011, p. 245). Confirmation bias, also known as "myside bias", also affects thinking in areas of life outside academia, such as politics and social issues (Evans, 2010; Kahneman, 2011).

In this workshop, students explore their own confirmation bias and are invited to change their beliefs if these are contradicted by what appears to be reliable evidence. They also consider whether statements made by others about climate change display confirmation bias or not, to give the students an opportunity to see how this bias might shape attitudes to an issue that is universally relevant.

The video clips

In the Wason Rule Discovery test, the tester gives the participants a sequence of three numbers, 2, 4 and 8, and invites them to work out the rule behind the sequence. The participants can propose a rule, and the tester tells them if this is the correct one or not. Participants can also propose three other numbers, and the tester tells them whether or not

they fit the rule. The tester gives no other information to help the participants. As shown by the first video clip, from Veritasium (2014), people usually decide on the rule "double the previous number" and stick to it, proposing sequences of numbers that fit this rule, such as "100, 200, 400", instead of testing their hypothesis by proposing numbers that do *not* fit. The rule is in fact "any three numbers in ascending order". The exercise demonstrates belief bias and confirmation bias.

The video clip demonstrates the Wason Rule Discovery test well, and would make the point about confirmation bias even if this test did not work as expected with the students. I chose this test because it is easy and fun to do, it seems to bring out confirmation bias in all kinds of people (I have found), and yet it does so in a non-threatening way that does not require participants at this early stage to lay deep-seated beliefs open to criticism. The Veritasium video also does a good job of relating confirmation bias to everyday life and to the scientific method, which might be relevant to some of my students' disciplines. The video from Facing History and Ourselves (2020) gives a clear definition of confirmation bias.

The gender and language activities

The three questions relating to stereotypes about gender and language are:

1. "Women talk more than men". True or False?
2. Which gender is more skilled at using (their own) language?

   a) Women b) Men c) No difference
3. "In discussions and decision-making, women are co-operative and focus on building relationships, whereas men are competitive and focus on getting things done".

   True or False?

It is expected that at least some of the students will choose the first answer, as per the stereotype. Cameron (2008) suggests that these stereotypes about women's discourse styles are international, so they can still be discussed even if students do not share them.

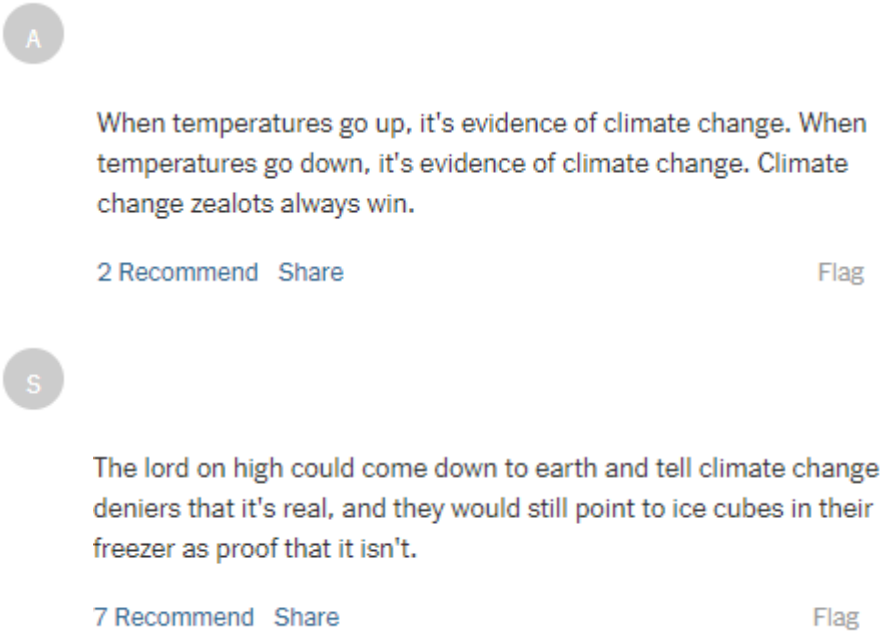
One of the points of this exercise, as in the Climate Change Quiz in Workshop 1, is to see if students are willing to change their beliefs if they are contradicted by reliable sources with credible evidence. I am using the topic of gender and language because I have found that people with quite different social or political viewpoints will claim that women and men communicate differently, seemingly without fearing accusations of sexism. For example, I have heard people with views on the political left and right argue that one reason we need more women in management is that they have a more cooperative way of talking to and working with other people. So I hope that students will not feel there is an "acceptable" view that they should express in this exercise to avoid embarrassment in the group, and that this will allow them to be more honest about their answers.

However, I have to be honest about my own confirmation bias in this matter! Although I was able to find nearly all of the original sources of the data I have used here about gender and language, they are all cited in Deborah Cameron's 2008 book "The myth of Mars and Venus", which critiques the "myth" that women and men communicate differently. In the session, I admit this by showing my copy of the book to the students, and invite them if they are interested to look for sources that dispute Cameron's claims.

The activity on confirmation bias and climate change

Interestingly, it was much harder than I had anticipated to find headlines from newspapers or claims from other organisations insisting that cold weather means climate change is a hoax (even from the Daily Express). So for evidence of this kind of confirmation bias, I had to look for comments from individuals on social media sites like Sheffield Forum, or comments below news reports online. Another recent change is growing confidence by some climate scientists that individual extreme weather events can be attributed to climate change (Vidal, 2015). However, I will allow the students to make up their own minds about this.

Here are two (anonymised) comments, one on each side of the argument, posted in response to an article in the New York Times: "Why So Cold? Climate Change May Be Part of the Answer" (Fountain, 2018).



The homework

I expect most students to be too busy to do much homework for these workshops, but I would like to think that they can begin to apply what they have learned to their everyday lives. This is the aim of the "thinking homework", and of course, I will be doing it myself. The first 10 or 15 minutes of the next workshop will be taken up with sharing the students' experiences.

Workshop 3: "Framing"

Belief bias and confirmation bias, which are explored in Workshops 1 and 2, help to form the "frames" through which we interpret information, and which are "constructed of our values, our life experience, and the social cues of the people around us" (Marshall, 2014, p. 80). Frames are deeply embedded in the human mind (Lakoff, 2010; Toplak et al., 2013), but critical thinkers need to learn to recognise and resist them (Toplak et al., 2013).

In this workshop, students learn about different types of framing and learn how it shapes decision making and attitudes to various social issues.

The homework revision (from Workshop 2)

I set the students homework at the end of Workshop 2, which was to choose a previously unexamined belief and actively look for evidence that contradicts it. I did this myself, testing for example my belief that students and teachers did not talk to each other on educational trips, or that in my male Chinese students spoke their mother tongue in class (which is not allowed) more often than the female Chinese students. This is to encourage the students to do the homework and to show that I am also willing to test my own biases.

The activities demonstrating positive/negative framing and loss aversion

Pairs of images are used to demonstrate how humans prefer positive over negative framing, for example, they are asked to choose which makes a joint of meat look more attractive, a label that says "10% fat", or a label that says "90% fat free". Games, such as mock bets, are used to demonstrate loss aversion; people are more willing to gamble in order to avoid an otherwise certain loss than to increase an already certain gain.

Students then move on to exploring how this framing operates in the real world by doing simplified versions of real psychological experiments involving doctors and public health professionals. The first original experiment showed that doctors were more likely to advise surgery for cancer if the risk was presented as a 90% chance of survival rather than as a 10% chance of mortality. The second experiment showed that health professionals were more likely to take a risk to tackle an epidemic if the decision to do so was framed as avoiding a number of lives lost for certain, as opposed to increasing the number of lives saved for certain. For the class simulation of these experiments I divide the class into two, and present each half with a different framing of the problem. The results of the original experiments showed that even highly educated and trained professions may be affected by these biases, so they are clearly very hard to resist. The concepts and experiments are taken from Kahneman (2011).

The painting

An Experiment on a Bird in the Air Pump is an oil painting by Joseph Wright of Derby (1768), depicting a demonstration of one of Robert Boyle's air pump experiments (in which a bird is suffocated) to a group of adults and children. I chose this painting because it works on two levels. By showing only parts of the whole picture, as in in a series of literal frames, I can trick the students into thinking the painting is about something quite different to a scientific experiment, such as a love affair. This demonstrates that framing involves "highlighting particular aspects of reality and hiding others" (Shaw, 2013). Secondly, even the picture as a whole can be interpreted in a number of ways; for example, it could be about gaining scientific knowledge; the importance of learning for children (or for girls); the dominance of the intellect over emotion; or animal welfare and ethics.

The quotations about climate change

The purpose of this exercise is to show that a problem can be framed in multiple ways, even if it is commonly framed in only one way; for example, climate change has traditionally been seen as an environmental problem, principally of interest to earth scientists and eco-warriors (Marshall, 2014). Changing the way an issue is framed can bring it to the attention of practitioners in other fields, and to the people they influence, who might previously have considered it of no relevance to them (Marshall, 2014). For example, in 2015 Mark Carney, then the governor of the Bank of England, gave a speech to insurance brokers warning that extreme weather events caused by climate change posed a global financial threat (Carney, 2015).

The quotations are put on the wall to encourage students to move around the room and provide some change of focus - there is a great deal of pair, group and whole-class discussion in these workshops, which might become tedious. The students can discuss the quotations with the person standing next to them if they like. The quotations are from a range of reputable or well-known sources: Greenpeace, Oxfam, The International Islamic Climate Change Symposium, the Pope, the Bank of England, the United Nations, the (British) Labour Party, the former conservative Prime Minister Margaret Thatcher, the London School of Economics, the Grantham Centre, and the UK Health Alliance. Climate change is

framed accordingly as an environmental, moral, religious, economic or political issue; or an engineering or technical problem.

The world-view frames

I wrote these world-view frames with reference to the work on risk and culture of Douglas and Wildavsky (1982) and other cultural theorists as described by Leiserowitz (2006), and to Kahneman (2011) and Triandis and Gelfand (2012). I also used the website of Hofstede Insights (n.d.a), a management consultancy that bases its services on the work of the social psychologist Geert Hofstede. It is worth noting that according to Triandis and Gelfand (2012), dimensions such as collectivism and individualism can be applied to the psychology of individuals as well as to cultures. The world-views and their sources are as follows:

1. *Humanity has been making steady progress since the beginning of civilisation.*

See Leiserowitz (2006) below for attitudes to technology of the different world-views.

2. *Most of society's problems are caused by a minority of people behaving badly*.

"Prototypical hierarchists most fear social deviance, which threatens the structure of the status quo… both hierarchists and individualists tend to embrace technology, which is viewed instrumentally as providing either more social control (if sanctioned by the 'experts') or more individual efficacy, respectively." (Leiserowitz, 2006, p. 49-50)

3. *The world is a very unequal place. We should try to make society as fair and democratic as possible*.

"Prototypical egalitarians … are most concerned about injustice in the distribution of risk costs and benefits, tolerate or celebrate social deviance and diversity, and view technology with suspicion" (Leiserowitz, 2006 p. 50).

4. *Individuals are responsible for taking care of themselves*. *They should have as much freedom as possible from government interference.*

"As interpreted by the important Chicago school of economics, faith in human rationality is closely linked to an ideology in which it is unnecessary and even immoral to protect people

against their choices. Rational people should be free, and they should be responsible for taking care of themselves." (Kahneman, 2011, p. 411).

5. *We all have a collective responsibility for looking after each other*.

"Collectivism … represents a preference for a tightly-knit framework in society in which individuals can expect their relatives or members of a particular in-group to look after them in exchange for unquestioning loyalty" (Hofstede Insights, n.d.b).

This statement about collective responsibility may appear similar to *3. The world is a very unequal place*, and a person with this world-view could be said to have egalitarian values. However, it depends on who the "we" that have a "collective" responsibility in this statement are – just one's own in-group, or the whole of society, or perhaps the human race? According to Leiserowitz (2006, p 50), egalitarians "are most concerned about injustice in the distribution of risk costs and benefits…" However, for Douglas and Wildavsky (1982), collectivism is a form of hierarchy, and indeed most collective countries also seem to be hierarchical. Costa Rica seems to be a rare exception (Hofstede Insights, n.d.c).

Workshop 4: "Cultures, tribes and taboos"

Workshop 3 was about framing, and ended with how a person's world-views lead them to frame issues in a certain way (see above). These world-views are formed in part by culture (Marshall, 2014). Cultural identity and the in-group/outgroup dynamic can lead to the socially constructed silence which is examined later in this session (Norgaard, 2006; Zerubavel, 2006).

Four types of culture (or, How do different countries deal with social problems?)

The four culture types I am using in this session form two clines, egalitarian to hierarchical, and individualistic to collective, according to the social psychologist Geert Hofstede (Hofstede Insights, n.d.b). Theoretically, the workshop is also underpinned by the work of Douglas and Wildavsky (1982) and other cultural theorists as described by Leiserowitz (2006), and of Kahneman (2011) and Triandis and Gelfand (2012), as explained in the

commentary to Workshop 3. I make it clear to students that although categorizing cultures as egalitarian or hierarchical, individualistic or collective can be quite useful for better understanding how they work, it is also a simplification which does not tell us everything about them (as students see later when comparing the Tea Party and Norway, both egalitarian and individualistic in culture).

In- and out-groups

For the theory of in-groups and out-groups, I used Open University (2020) and also Rabinovich et al (2012). I am using my own story about growing up as an Anglo-Scot in Glasgow to illustrate the concepts of in-groups and identity, and how one might suppress personal information, opinions or feelings in order to be accepted by the group. This is partly because I find that students usually enjoy teachers revealing a bit about themselves, and it seems only fair if I am also asking them to talk about their own experiences and background. Also, I do not wish in any way to suggest that any of the potential barriers to critical thinking apply to students but not teachers, or to non-Western cultures but not Western ones (see also my use of the UK, Norway and the US in this workshop).

Norway and the Tea Party

The information about Norwegian society and values given to students comes from the website Study in Norway, "The official gateway to Norwegian education" (Study in Norway, n.d.). The information about Tea Party values comes from their own website (Tea Party Patriots, n.d.).

Interestingly, the Tea Party and Norway could both be classed by the cultural theorists mentioned above as having egalitarian and individualist cultures. Their differing values result in quite different reactions to the issue of climate change. Tea Party members are able to dispute the experts' consensus on climate change with no feelings of conflict or embarrassment because to do so is perfectly compatible with their cultural identity as individualists who mistrust the scientific establishment and the State. The Norwegians in Norgaard's 2006 study suffer cognitive dissonance as they try to reconcile their national

self-image as a simple people who are close to nature and concerned about climate change with the knowledge that they owe their affluent lifestyles to their country's vast oil revenue. The Tea Party could also be said to suffer from confirmation bias when they claim: "We want to know the truth … we search for our own answers" (Marshall, 2014, p. 19) while simultaneously refusing to believe what climate scientists say.

Elephants in the room

This follows on from the exploration of the cognitive dissonance over national oil wealth experienced by the Norwegians in Norgaard's 2006 study, and from the students' discussion of what they could not talk about in their own in-groups. My hope in this stage is that students will be encouraged to think about subjects that cannot be raised, or stances that cannot be disputed, in their culture, and why this is so. This might be a first step towards the students problematizing the avoidance of, or lack of discussion around, these topics, especially if they are accustomed to accepting this situation without question. Exploring such sensitive areas can be tricky, and students cannot necessarily be expected to start challenging deeply entrenched cultural norms in one 90-minute session, but I think critical thinking entails at least acknowledging them.

Workshop 5: "Assessing probability and risk"

A number of disciplines and professions require the accurate assessment of risk, and by implication probability, for example business, insurance, public health, medicine and engineering. We all calculate risk and probability in real life situations too, and it is an area where it can be demonstrated that our intuitive, instinctive System 1 often obstructs rational, analytical System 2 (Kahneman, 2011). So it is worth including it in a course aiming to raise awareness of barriers to critical thinking.

Three cognitive biases

I used three problems that demonstrate common mistakes humans make when assessing risk. The "gambler's fallacy" (Evans, 2010) is the belief that a coin or roulette wheel has a

memory and will adjust its results to achieve an expected average; if for example a tossed coin comes down heads 5 times in a row, the gambler might believe (falsely) that next time it must come down as tails. The "Linda problem", taken from Kahneman (2011), describes a woman with "typically" feminist characteristics, and asks whether it is more likely that she is a bank teller or a feminist bank teller; many people, influenced by stereotype or "representativeness", would mistakenly choose the latter answer. The third common mistake, also taken from Kahneman (2011), is to ignore the rule of "regression to the mean", in other words, that better than average performances or outcomes (for example in sports) are statistically likely to be followed by poorer than average ones, and vice versa.

The risk matrix

The risk matrix is used in risk assessment procedures and attempts to quantify risk using two vectors, severity and probability (Science Direct, 2020). I am using one in this session because it is a good example of an attempt to quantify risk logically and dispassionately. However, Kahneman (2011, p. 140 -1) quotes the psychologist Paul Slovic, who says that objective risk does not exist, but is a concept humans have invented. This is because to consider one event or outcome worse than another is a matter of human judgement. For example, all deaths are equal in gravity to "experts" in fields such as public health, but for the general public, there are good and bad deaths. So I will be careful not to suggest that emotion should not be part of risk assessment, but to show that these affective factors are essential to understanding how people really assess risk (APA, 2011, pp. 25- 26).

The human factors in risk assessment

These are in addition to the purely cognitive biases that lead to inaccuracy when assessing statistical probability described above (the gambler's fallacy, and mistakes relating to representativeness and regression to the mean). The influence of emotional language, images and personal stories on risk perception is discussed by the American Psychological Association (2011). This is an example of the sentence pairs I used to show that language affects our perception of risk:

a) We killed some innocent people by accident when we attacked.

b) There was some collateral damage.

The two sentences describe the same outcome, but “a” sounds far worse than “b”.

To demonstrate the impact of imagery and personal stories shape on perceptions of risk, I showed the students this statistic about the increased likelihood of flooding in India:

> Climate scientists at the Indian Institute of Tropical Meteorology have found “a three-fold increase in widespread extreme rains during 1950-2017, leading to large-scale flooding” (Phys.org, 2018).

I then showed them a harrowing clip of the effects of a flood on a rural community in India by the Climate Reality Project (n.d.).

The effects of optimism, future discounting, availability bias, and the bystander effect are described by Kahneman (2011). Optimism causes people to ignore the statistical likelihood that their own ventures, for example in business, will fail. Future discounting makes losses and gains seem less significant the further in the future they are. Availability bias makes disastrous events seem less bad if they happened a long time in the past and are therefore harder to recall, meaning that people gradually forget to take precautionary measures against earthquakes, for example. The bystander effect causes people to take their cues about risk from the reactions of others, which is why people often do not respond appropriately to fire alarms unless prompted to by an authority figure.

Workshop 6: “Review”

The review quiz

The aim of the quiz is to review the workshops for those students who attended them, and fill in any gaps where they did not. The questions do not of course cover every aspect of each workshop, especially for Workshops 4 and 5, which were particularly complex, but attempts to cover the most important points in an engaging way. With luck the students

might be motivated to go back and review the original materials, which will still be available to them on Google Drive.

The text (s) and critical thinking task

The main text used in this workshop is a report in the *Sun* newspaper on the wildfires of the summer of 2018 (Sims and Hodge, 2018). The text they are given to take home is an opinion piece from the *Guardian* newspaper (Guardian, 2018).

There are six questions in the task. Question a: *Does this text use any sources? How reliable do they seem? How are they used?* relates directly to Workshop 1, on sources. Question b: *Does the writer use any evidence? How reliable does it seem to be? How is it used? Do you think anything important has been missed out?* aims to help students notice any confirmation bias (Workshop 2) in the form of evidence used selectively. Question c: *How has climate change been framed in this text?* relates directly to Workshop 3, on framing. Question d: *Who is the audience for this text, do you think? How do you know?* is about audience, and reminds students that writers often write in a particular tone for their own "tribe" (Workshop 4). For example, the *Sun* is a tabloid that reports sensationalist news, and its online report is surrounded by dramatic images of wildfires as these might attract its target readers. The writer of the opinion piece in the *Guardian* assumes that this paper's readers will already be persuaded that climate change is a serious problem requiring urgent action. Question e: *Do you think this text is balanced? Can you see any bias, stereotyping, etc.?* also covers this angle in that writers might stereotype people in the readership's out-group, as may be happening with the *Guardian* article's treatment of President Trump. It also asks students to look for other biases, which might relate to any of Workshops 2 to 5. Question f: *Does the text use any emotional language to try to influence the reader's opinion?* deals with emotion as this is a factor in the barriers to critical thinking covered in Workshops 5 and 6. However, arguably emotion is a factor in confirmation bias; framing and world-view; culture, identity and in-groups; and risk assessment, that is, the content of most of the workshops.

The text from the *Sun* is a demonstration of what students have to do at home with the other text, from the broadsheet newspaper the *Guardian*. The whole exercise is meant to give the students an opportunity to put what they have learned about critical thinking into practice. The texts are very different in their viewpoint, tone, purpose and target audience, so I hope this will highlight the importance of being aware of these factors when reading critically.

Appendix 3

Revisions to the workshops

Below is a summary of the revisions made to each workshop between the courses starting in February, May and October 2019, and my reasons for making these changes. Please see the Methodology chapter for a summary of each workshop.

Workshop 1: "Source reliability"

Changes from the February start course to the May start course:

1. I began the session by eliciting and providing basic information about the causes and effects of climate change.

REASON: I discovered in the first workshop I ran in February that not all the students understood how emissions of carbon dioxide and other gases cause the greenhouse effect that leads to global warming and hence to climate change. The purpose of the new stage was to make sure that all the students in the group had the same basic knowledge of climate change before starting the quiz, which covered the topic in more detail. This was to avoid wasting time while more knowledgeable students explained the basics to less knowledgeable ones, and to minimise any embarrassment at their ignorance the latter might feel.

2. After the students had done the climate change quiz in the February start course, I gave the students some information on the sources behind each possible answer and asked them to decide which answers/sources they most believed. Then I elicited and gave criteria for evaluating sources before giving them more information about the sources and asking the students to evaluate them. After the quiz in the May start course, I gave the students all the information on the sources *without* saying which answers they referred to, and asked them to evaluate them as sources

of information about climate change. Only then did I reveal which sources supported which answers.

REASON*:* If students did not know which sources supported their initial answers, it was less likely that this would influence their evaluation.

3. I shortened the quiz, putting the first question on a presentation slide to demonstrate what I wanted students to do, and removing one question, which was

   "Economic growth is incompatible with solving climate change". (This means, we can't solve climate change and also have economic growth).

   True or False?

   I also reduced and simplified the information on the sources, and gave them a single information sheet instead of a short one first, followed by a more detailed one later (see above).

REASON: Students found the amount of text they had to read quite heavy in February, and we ran out of time to do the last discussion activity about source reliability and belief bias (although this activity was not crucial to the success of the workshop).

4. I added a slide at the end of the presentation that summarised the main points of the workshop. I did the same for all subsequent workshops in this course and the October start course.

REASON: I realised during the May start course that there was so much information and theoretical background in each workshop that the students might not retain the main points unless these were systematically recapped at the end. It also gave students an extra opportunity to ask questions about any points they did not understand.

Changes made to Workshop 1 in the October start course:

All the changes made in the May start course were retained.

In addition, I asked the students to mark their original answers to the quiz in blue and any corrections in red, and then I took in the papers (which did not have the students' names on them).

REASON: To see if students had changed their answers if they found that these were not supported by a source they themselves had said was reliable. This might indicate if they were still affected by belief bias.

Workshop 2: "Confirmation Bias"

Changes made to Workshop 2 in the May start course:

1. I showed a video clip from the popular science website Veritasium to demonstrate the Wason Rule Discovery Test and to explain how confirmation bias works (see the References). In the May start course, I added a slide with some comprehension questions to show after the clip.

REASON: In February, I found that eliciting the key points from the video was laborious and increased the teacher-centred time at the presentation stage. Putting the comprehension questions on the slide gave me the option of allowing the students to discuss the answers in pairs and clarify the key points for themselves.

2. In the February start course, I showed a clip from a video lesson from the website of the educational organisation Facing History and Ourselves which defined confirmation bias (see the References). In the May start course, I added two slides to my presentation, one explaining the academic vocabulary used by the speakers in this clip, and the other giving a simplified definition of confirmation bias.

REASON: In February, some students did not understand the definition on the video at first and needed some more explanation. I kept the video though because the definition it showed was comprehensive, and it had clear and helpful graphics; many of the students understood it straightaway without further help.

3. In the February start course, I showed students another clip from the Facing History and Ourselves website which explained how news sites on social media create echo chambers of opinion. I dropped this from the May start course.

REASON: To save time, and because I felt I could explain this concept myself more concisely and clearly to students whose first language is not English.

4. In the February start course, I gave students a handout with two extracts about how confirmation bias affects attitudes to climate change to consider and discuss in the lesson. One was from Howe and Leiserowitz (2003). The other was from Zanocco et al. (2018). I dropped this from the lesson itself in the May course, and invited the students to look at the extracts at home if they wished.

REASON: Students are tired on a Friday afternoon, and most of them are not specialists in psychology or sociology, so they found these extracts rather heavy going. I found in the February start course that I needed a better balance between expounding theory in the abstract and giving students practical activities to do which conveyed the key points.

5. I added a slide at the end of the presentation that summarised the main points of the workshop (see the changes to Workshop 1 above).

Changes from the May start course to the October start course:

All the changes made in the May start course were retained.

These additional changes were made:

1 In all the courses, I gave the students this question to discuss: "*In discussions and decision-making, women are co-operative and focus on building relationships, and men are competitive and focus on getting things done". True or False?* In the February and May start courses, I followed this with a handout with extracts taken by Cameron (2008) of a group of girls and a group of boys doing the same discussion task (with the names replaced by initials). Students then had to discuss which group was all male, and which all female, on the basis of their conversational style. I dropped this from the October course.

REASON: In the February and May start courses, not all students agreed that men and women have different discourse styles, although this is a commonly held belief. So it did not make sense to ask students who did not hold this belief to try and discern the gender of

the children in the conversations. In addition, I found that the True/False question that preceded this activity did the job of exploring this belief almost as well, and was less time consuming.

2 In the October start course, I asked the students to write down their answers to the questions about male and female discourse styles using blue or black pens, and to amend their answers in red pen if they had been persuaded by the evidence contradicting the stereotypes which I had shown them. I then took in their papers.

REASON: To see if students had changed their answers in the light of the evidence. This might indicate if they were still affected by confirmation bias.

Workshop 3: "Framing"

Changes made to Workshop 3 in the May start course:

1. In February, I asked students to consider each of five social issues - drug addiction, gun control, homelessness (or poverty), climate change, and the surveillance society - from five world-viewpoints as described in the Commentaries on the Workshops in Appendix 2. In May, I asked them to consider only the issue of homelessness from the five world-view points in class, and to think about the other issues for homework.

REASON: Five issues proved to be too many to be considered during the session, due to time constraints. Homelessness was a good choice to demonstrate how to do the homework because it was relevant to each one of the world-views, which was not necessarily the case for the other social issues.

2. I added a slide at the end of the presentation that summarised the main points of the workshop (see the changes to Workshop 1 above).

Changes made to Workshop 3 in the October start course:

All the changes made in the May start course were retained.

In addition, I asked the students to mark their answers to the psychological experiments on the papers provided for me to take in.

REASON: So I could see if students were influenced by how the decision in the experiments were framed.

Workshop 4: "Cultures, tribes and taboos"

Changes made to Workshop 4 in the May start course:

1. In the February start course, I introduced the concepts of collectivism, individualism, hierarchy and egalitarianism at the beginning of the session. Then I gave the students a handout about the contrasting ways in which culturally different countries dealt with drug addiction, gun control and surveillance, and invited them to discuss the reasons for the differences. In the May start course, I reversed these stages.

REASON: I decided it would be better to let students come up with their own ideas about the differences between the countries' approach to the social problems first, before I explained how these might be explained by cultural theory. This way I was not leading the discussion too much, and was able to incorporate these concepts into the feedback stage so I could link them better to their own ideas.

2. In the May and October start courses, I showed a slide picturing George Marshall and Kari Norgaard to introduce their research amongst Tea Party members and Norwegians respectively into how attitudes to climate change can be shaped by cultural identity. I then explained what they were trying to find out in their research before I showed the students the findings. I also simplified the slide showing Norgaard's findings about cognitive dissonance in her respondents.

REASON: In the February start course, the students found it difficult to understand the concepts I was trying to convey in this stage. I thought that more explanation about the researchers and their aims before they looked at the results would help with this.

3. I added a slide at the end of the presentation that summarised the main points of the workshop (see the changes to Workshop 1 above).

Changes made to Workshop 4 in the October start course:

All the changes made in the May start course were retained. There were no further changes.

Workshop 5: "Assessing probability and risk"

No changes were made to Workshop 5 in the May start course, except for the addition of a slide at the end of the presentation that summarised the main points of the workshop (see commentary to Workshop 1 above).

Changes made to Workshop 5 in the October start course:

1. I dropped an exercise about taking account of base rates, adapted from Kahneman's "Tom W problem" (2011, pp. 146 – 150).

REASON: To save time, and because the main point of this activity is covered by the exercise demonstrating the effects of "representativeness".

2. I removed a video from the Veritasium website (see the commentary to Workshop 2) which demonstrated "regression to the mean".

REASON: To save time, and because I felt I could explain this concept myself more concisely and clearly to students whose first language is not English.

3. I invited students to consider where they would put the risk posed by climate change according to the scientific evidence on a risk matrix, which plots the likelihood of an event against its severity. Then they were asked to place it according to the perceptions of this risk in the general public and speculate about the reasons for the gap between the two. To do this, in the February and May start courses I asked them to discuss this question in groups: "If you judged the risk according to how

individuals and governments are reacting to climate change, where would you put it?" In October I changed this to a series of questions about their personal levels of concern and that of their family and friends, how often they thought or talked about it, and whether they factored it into their decisions about the future, and asked them to place the issue on the risk matrix according to their answers.

REASON: This activity did not work as well as expected in the February and May start courses. I came to the conclusion that the students in my workshops, especially the Chinese students who were the majority of the class, generally trusted their government to deal with the problem of climate change more than Western students might. This meant that my students did not necessarily perceive a gap between the urgency of the problem as indicated by climatologists' warnings, and the influence of climate change on actual policymaking. The students did, however, display similar personal attitudes to climate change observed in studies conducted mostly in the West, as summarised in the 2011 report by the American Psychological Association. That is, they knew it was a serious global problem but did not feel personally threatened by it (see the Discussion chapter). The new version of the activity, which dropped the reference to "government" and highlighted their own feelings about climate change rather than "individuals" in general, was much more effective in highlighting the gap and making the students think about the factors that affect risk perception.

Workshop 6

Changes made to Workshop 6 in the May start course:

1. After the revision quiz, I asked the students to analyse an abridged version of a report from the *Sun* newspaper about the wildfires that broke out all over the world in the summer of 2018, by applying what they had learned about critical thinking in the previous workshops. In the May start course, I first showed the students the images accompanying the online *Sun* report on the Interactive White Board.

REASON: I wanted the students to consider the effect on the reader of the dramatic images of wildfires in the original report. I did not do this in the February start course because there were too many images to print, and I had not yet worked out how to block unsuitable images from advertising on the website.

2. I originally prepared five texts to be analysed in class, intending to give each group a different one. In the February start course I only had time to cover the *Sun* text, but in the May and October start courses, I gave them an opinion piece from the *Guardian* to take home to analyse in the same way if they wished.

REASON: Lack of time.

3. I added a slide at the end of the presentation that summarised the main points of the workshop (see the changes to Workshop 1 above).

All the changes made in the May start course were retained in the October start course. No further changes were made.

Appendix 4

Rules for categorisation

Critical thinking

Questioning and analysing

Items in this category may also appear in other categories, such as "culture" or "independence and initiative". Questioning and analysing are combined into the same category for the reasons given in the Methodology chapter (p. 85). An item is categorised under "questioning and analysing" if it follows one or more of the following rules:

The item contains the words "question", "analyse", their grammatical variants, or their synonyms, in relation to critical thinking:

> Hilary: Before I just, uh, I try to think some method to question some question, but I don't know some theory, you know, theories
>
> Olivia: Now I understand more in details that a good critical thinker is someone who doesn't just passively take what's been told, but actively analyses the information and think independently to have a conclusion of agreeing or disagreeing
>
> Lohita: Critical thinking is way of assessing the content from various aspects (Pre-Course Task)

The item contains adjectives which imply questioning, such as "sceptical" or "suspicious", in relation to critical thinking:

> Hilary: Yeah, I think at first I have idea about critical thinking is have spectacle [sceptical?] way to think something.
>
> Helen: … critical thinking encourages us to challenge the perspective of mainstream while we should keep suspicious of everything … (Pre-Course Task)
>
> Helen: Yeah, but – for me, before I just think critical thinking is challenging the existing theory, and just like you become very picky ... and just find the loopholes and the disadvantage

The participant describes activities or attitudes which imply questioning or analysing (or a lack of it):

> Jade: if someone says it's right, I think maybe it's wrong
>
> Hilary: In a company, every company have different rules. You know that. Yes. So everybody should obey that rules. Although sometimes it may be wrong.
>
> Cyan: Basically, I think based on my opinion, I think critical thinking is for problem or for issue, to know and to explore what it is, how does it work, and why it happened. Maybe I guess this is what critical thinking is

The items include a reference to concepts related to questioning and analysis that have appeared in the workshops. (For example, the concept of the "elephant in the room" was introduced in Workshop 4 to demonstrate how social pressure forbids people from questioning certain assumptions or acknowledging issues that might otherwise be subject to analysis).

> Hilary: I mean, like the [unclear: freezing?] elephant actually happen in anywhere, but I think especially [Sam: in our culture] in my work experience, actually that is somebody just [Yaling: Really?] not – just ignore that, although it is there.
>
> Dandan: OK! From today's [workshop], you show us this reading, you say, who is the audience for such as a newspaper, who is the audience for this text, and look at the source and evidence, [unclear] such as a professor and minister, they say blahblahblah, and also, "How has the issue or problem been framed. Are there any other ways of framing this?" And also, "Can you see any bias?" "Does this use any emotional language to persuade you?"

Multiple perspectives

The two categories of "multiple perspectives" and "framing" are closely related, but do not share any items (see also "framing", below). An item is categorised under "multiple perspectives" if it refers to different "perspectives", sides" or "views", but is not specific about how an issue might be framed, e.g. as economic or environmental (see also "framing" below). Items in this category should follow one or more of the following rules:

The item contains words or phrases that mean or imply "different", "many" or "both" in conjunction with the word "perspective/s" or its synonyms, in relation to critical thinking:

> Rose: Thinking from many different angles (Pre-Course Task)
>
> Joy: Thinking about both positive and negative aspects (Pre-Course Task)

> Hamra: I try to think in the opposite side
>
> Lohita: … now I understood that I have to search all over a broad spectrum, which explains from every aspect of the world
>
> Sophia: … what's the standing point among different people. So what are different people's viewpoints?

The item refers to or suggests the quality of being "open-minded" in relation to critical thinking:

> Sam: We should be open-minded
>
> Abda: Yeah, yeah. So we have to understand the reasons, what they did that. Sometimes when you listen to the reasons, ah, you will be persuaded!

The participant denigrates the practice of having only one point of view:

> Olivia: I hate that China only tell me the one story they want to tell
>
> Max: Maybe - in my opinion, or in my past experience, I just think about in one way thinking. [Kathy: Yeah]. Yeah, yeah, in one way thinking. I don't know how to explain my opinion or my thinking

Argument building

This category also includes references to deconstructing arguments (see the second example below). An item may or may not include using evidence or sources; if so, it goes into the "evidence and sources" category as well.

An item is categorised under "argument building" if it follows one or more of the following rules:

The item contains the words "argument", "prove" or "judge", or their grammatical variants:

> Violet: I think [critical thinking is] be able to like have your own opinion, argument, what you think of, when you are looking at the reading, or writing
>
> Sam: I mean before I think it's more like, find something that's missing or wrong in prove process
>
> Jean: Critical thinking is the skill to think different aspect of the issue and create a judgement (Pre-Course Task)

The item contains references to supporting one's opinion, with or without mentioning evidence:

> Rose: I can think what is right thing support me and what is against my idea
>
> Jade: It changed a little, because I think they might support, the evidence just from the news or some reports, and when I finished the class I find there are many resource, some is from the scientific organisation, or some just the magazine [academic journals?] or to choose to support the own opinion, I think

The item contains references to explaining one's point or position to others, or persuading others:

> Max: I don't know how to explain my opinion or my thinking
>
> Lohita: And I understood why it is important to have your perspective, and be courageous about it, and how you can explain your point to the other person
>
> Olivia: critical thinking for me now, I think [pause] it's not about one conclusion or one belief, it's like you can sort out your conclusion with the resources you have, the information you have, you can sort it out with the logical way [Kathy: Yeah] and use that to kind of persuade someone else

Confirmation bias

Items in this category may also appear in other categories, such as "self-awareness". An item is categorised under "confirmation bias" if it follows one or more of the following rules:

The item contains the phrase "confirmation bias":

> Abda: The workshop it was that influenced me and I understand everything in there and it was very useful. I think it was the confirmation bias
>
> Melina: I think I have more information about critical thinking, that we use our framing, and our maybe confirmation bias, and to look to the evidence that we want to match our beliefs

The participant describes confirmation bias without using those exact words:

> Dandan: So, people always you know cherry picking, they choose which one they feel comfortable, and they like
>
> Olivia: If you want to believe China is bad, you won't listen to all these other press said China is doing a good thing
>
> Jean: Just like we want to find some reference to support us, but we don't want to find any reference that can, um, take the opposite, I mean [Cyan: against] like judge our idea

The participant describes how to avoid confirmation bias, without using those exact words:

> Sam: And also try to disapprove [disprove] your [own] opinion, yes
>
> Helen: The most - the remarkable point that Kathy said I think is that we believe one belief, then we need to find everything against it [others say "yeah"] and if everything wrong, then you are probably right

Use of evidence and sources

Items in this category may also appear in other categories, such as "argument building". An item is categorised under "evidence and sources" if it follows one or more of the following rules:

The item contains the words "evidence" or "source/s" in relation to critical thinking:

> Abda: For me I think it was very useful, even now, I can, for example, if somebody said, inform me with some information, so I go to my phone and look it up, and find the source, is it right or not, it's supported by evidence or not

The item contains other terms which refer to sources, (such as "resources", "references" or "research") or to evidence (such as "data" or "information"), in relation to critical thinking:

> Olivia: 'Cause we, we – there must be something new about the topic that comes up. Like, if we are, like, examining the climate change, there will be a new newspaper, new research, new report, will come up [Kathy: Yeah] and we will never have the, how you say, enough information, for ever
>
> Sophia: I still think climate is changing, but I can reflection on this question. Yes, some news has already reported on this. I think I need more statistics or data to convince myself, such as how to evaluate this news, during a long period. And I need to see the different data during different time, and different years, to convince. So, how the climate change or in what kind of way it is changing. Maybe I need more to read, to convince

The participant implies that critical thinking involves the use of evidence, as opposed to unsupported belief:

> Abda: Also, another point [unclear: applying here?] we have to accept facts, even if against our belief and our what we think
>
> Olivia: But, I've still got my problems, 'cause, I think about it, why I change my mind so easily it's because I don't have much knowledge to support my belief

Framing

The two categories of "framing" and "multiple perspectives" are closely related, but there are no items which appear in both categories (see also "multiple perspectives" above). An item is categorised under "framing" if it follows one or more of the following rules:

The item contains the word "frame" or "framing", or the word "picture" in the sense of how an issue is framed

> Melina: I think I have more information about critical thinking, that we use our framing
>
> Yaling: We should to think outside of our frame
>
> Hamra: I usually try to look to the bigger picture, than the small one

The participant is specific about how an issue might be framed, rather than simply saying there is more than one way of looking at it (in which case, it would be put in the "multiple perspectives" category). The term "framing" itself may or may not be used:

> Olivia: That's how, like, different parties, they saw the issues, like if you think it's a climate thing, you will do it that way. And if you think it's an economic thing, you will do it that way
>
> Dandan: And for such as framing, I think I have more, especially for the climate change, economic issue, religious issue, political issue, I don't know about that, but I also know the health issue and this is environmental issue
>
> Sophia: When I ask them [her participants] maybe I should think about, who are they? A teacher, or a management, or...? What kind of work he is doing … he's doing something about financing, or just teaching. Where he or she is from?

The participant describes what they had learned from Workshop 3 about the formation of frames, without necessarily using that term:

> Max: And the bias is just from our experience or our values, or the other things
>
> Jade: [Referring to Workshop 3 on "Framing"] To know about, uh, cannot judge from a small part to the whole thing, and because every part of the picture shock me, we think about many stories!

Independence and initiative

Items in this category may also appear in other categories, such as "questioning and analysing". An item is categorised under "independence and initiative" if it follows one or more of the following rules:

The item contains the word "independent" or its grammatical variants, in relation to critical thinking:

> Yaling [Critical thinking is] thinking independent
>
> Olivia: Now I understand more in details that a good critical thinker is someone who doesn't just passively take what's been told, but actively analyses the information and think independently to have a conclusion of agreeing or disagreeing

The item contains references to having one's own ideas as opposed to simply adopting those of an authority:

> Portia: When we learn something, we should have our [own] ideas
>
> Dandan: So, after thinking, I think, I found read newspapers, also be critical, because before, I always think they are authorities, such as the Economist. I think they are authorities, but no, maybe not, they also write by people, people's view

The item contains references to resisting pressure to conform, or the inability or failure to do so:

> Helen: I think critical thinking is, we can challenge the mainstream point of view, and sometimes one thing happen, and everybody thinks it's wrong, but not wrong in every circumstances
>
> Yaling We're often influenced by others. Even if we know this is not the right thing
>
> Olivia: Ah … I think I changed a little bit, 'cause, before that, ah, I was very, like envy those people who stand their, like, belief very firmly, 'cause I always been persuade, like this way, and this way, I change my mind very easily

The item contains references to taking the initiative or failing to do so, in relation to critical thinking:

> Hamra: After the video of the alarm, I say to myself, "I will be the first one, uh, in this situation, I do not need to wait someone to make, encourage me to go out, or in anything, not in, just in ah, danger situation or something like that". So, yeah, I will try like to improve myself in this situation, yeah
>
> Olivia: Uh, and when the earthquake happen, we can see the things shaking … and nobody move in our classroom. And, after, like, I have to say, ten seconds? And someone shout, like, let's run out of the classroom. So that's when we ran ... and [the boy who said "run" is] the one who always do the different things as us

Culture

Items in this category may also appear in other categories, such as "framing". An item is categorised under "culture" if it follows one or more of the following rules:

The item contains the word "culture" or its grammatical variants, in relation to critical thinking:

> Sam [referring to the "elephant in the room" phenomenon]: But I thought this is our culture's problem, but now I think it's more like human nature's … [laughs]
>
> Olivia: So, it has something to do with your culture, your, like, your life experience, that … make you confirm what you believe

The participant refers to aspects of their own or another culture (without necessarily using the word "culture") in relation to critical thinking. This includes references to the influence of their culture on the participant's own thinking:

> Hilary: [referring to the "elephant in the room" phenomenon] this is very common in China
>
> Ayşegül: So, I realise the people who attend this courses is the Asian people ... And also it's a good opportunity to learn the how Western people's thinking [laughs]
>
> Olivia [referring to her confusion when hearing alternative views of her country from non-Chinese students] But I love China because I grow up there, and - there's something I believe, I can't change it, 'cause I really think that's true, 'cause I live there for 20 years

Deeper understanding of critical thinking

Items were put in this category if participants said that the workshops had improved their understanding of critical thinking *in general*, although they may also have cited as examples particular areas, such as confirmation bias or self-awareness (in which case, the item would appear in these categories as well). They may also appear in the category "workshops are useful or engaging". An item is categorised under "deeper understanding of critical thinking" if it follows one or more of the following rules:

The participant says or implies that the workshops have helped them to achieve a deeper, broader or more complex understanding of critical thinking than they had before, or helped them to apply critical thinking. Items may compare the workshops favourably with other

courses in this respect, and may or may or may not include the phrase "deeper understanding" or any of its grammatical variants:

> Max: So I think now I have deep understanding about the critical thinking
>
> Joy: [Before the course] our definition of critical thinking is just about thinking about both positive and negative sides but we didn't notice it's really a broader thing
>
> Hilary: Every [workshop] give some different kind of guidance. It help you get more informant about critical thinking in your life
>
> Mary: Before the course, I think that critical thinking is - I only know the word, critical thinking. I know when I write my dissertation I need to think more and have some critical thinking, but I don't know how to exactly do it. After the course, I think I know something about it
>
> Robin: after the semester or study the critical thinking course I think critical thinking is complex, you need to experience it further and further
>
> Portia: I think this kind of workshop is very useful, very useful than the lessons, compared to my department's courses

In these items, participants may indicate that learning about theories or concepts helped them achieve a deeper or broader understanding of critical thinking:

> Max: it give me a basic theory in my mind
>
> Joy: from this course I learned more about these theories, sometimes we didn't notice this, like, um, the something we didn't notice, but it really influence us, you know
>
> Cyan: based on these workshops, I think I find some principles or… theory, this looks like, ah, guidance, for me

Workshops are useful or engaging

Items in this category may also appear in the category under "deeper understanding of critical thinking". An item is categorised under "workshops are useful or engaging" if it follows one or more of the following rules:

The item contains the word "useful" or "benefit", their grammatical variants, or synonyms, in relation to the workshops:

> Abda: Yeah, it was very useful so I understand many things there and I think about it. So it was very useful
>
> Olivia: But I can see the benefits of practicing critical thinking skills. I would really appreciate more critical thinking related courses as I find this skill is significant for not just academic study but also in life

Max: Really, really, it influenced me a lot. And positive influence

Lohita: I have done here, in the 301, because our assignments, in India it's not like this, so I have learned all these things here, in different workshops around the University but [your workshops were] more practical

The participant implies that they have found the workshops useful or beneficial:

Lohita: I can criticise in my assignments, and I can criticise the articles and I have the power of it …. Because, I need some support, so I think your workshops support me ... yeah, it's OK to think critical

Agnes: Yes, I think this workshop give us the reason and the causes of why we need critical thinking, rather than other courses just tell us you need to, how to do critical thinking

Dandan: This is really a great chance for me to examine my learning

The item contains the words "interesting" or "enjoyable", their grammatical variants, or synonyms, in relation to the workshops:

Hilary: I think topics are all very interesting

Ayşegül: [Looking at the PowerPoint slide] "the activities", yes, I enjoy with these activities

The participant implies interest or enjoyment:

Agnes: The experiments, some social experiments, given by teacher is very vivid for me

Melina: I like actually the stories, the practice, the things that you made us to do. I like the story about the girls and the boys and we tried to guess who is the boys and the girls [in Workshop 2]. I like the pictures that we tried to imagine or guess what was it about [in Workshop 3]

Difficulties and challenges

Items in this category may also appear in other categories, such as "critical thinking as a process" or "confirmation bias". An item is categorised under "workshops are useful or engaging" if it follows one or more of the following rules:

The item contains the word "difficult" or its grammatical variants, or synonymous words or phrases, in relation to critical thinking:

> Agnes: For me, before I attended this course, I thought critical thinking is very boring and difficult
>
> Violet: Probability and risk ... I think I found it more challenging than the others. It was kind of new
>
> Rose: at first it was just a little confusion for me about some, uh, how to identify what is framing, or what is the confirmation bias
>
> Cyan: When I the first time to attend a workshop, I was also cannot totally understand the, maybe I can only understand 60 % or more or less

The participant describes their struggles in developing critical thinking (as described in the Analysis chapter):

> Olivia: So I do some research, [takes deep breath, laughs] and all I can find is all the bad things about China [Kathy: Ah!] So I'm like, am I being fooled for my 20 years? Whole life? [Kathy backchannels throughout the following]. What I'm being told is totally wrong? Is the, what's the news here, what I find on Google, that's the correct things? So I question a lot, and after that I take a Global Relation course, and they are teaching those things completely different from China, so I always question - I'm not a critical thinker. 'Cause I don't have all this knowledge outside of China, so – After that I don't believe in myself
>
> Helen: So when I just come here, I feel very struggling, because different ways of learning, I feel getting lost

Respect for others' views

An item is categorised under "respect for others' views" if the participant shows an understanding that another person's view may be equal in value to one's own, even if one does not agree with it.

This is how Lohita describes this quality:

> And I understood why it is important to have your perspective, and be courageous about it … and … how you can explain your point to the other person, that why I am thinking this, and keeping in mind that you have to respect the other's opinion as well

Olivia describes its opposite:

> When sometimes people are – arrogant? They don't listen to other people's – you know, that's really wrong! And you want to tell them what – it's not what's correct, but there's another side of the story you want to show them, but they don't listen, they really don't listen

Both the above items were put into the "respect for others' views" category.

Items in this category often appear under “multiple perspectives” as well. For example, these items were placed in the categories for both “multiple perspectives” and “respect for others’ views”.

> Sophia: At the beginning of the class, I answered several questions, but it’s just from my perspective, not from the people who gave the claims. You keep asking me, thinking about the other people’s perspective. After listening to other classmates, I get the point. I should guess what other people say. What’s their standing point? So that’s very important
>
> Melina: We have to criticise [an article from] lots of points of view. And something seems not good for me, this article, maybe it seems good for someone, so I have to think about that

Self-awareness

Items in this category may also appear in other categories, such as “confirmation bias”, “critical thinking as process” or “deeper understanding of critical thinking”. An item is categorised under “self-awareness” if it follows the following rule:

The participant indicates an awareness of their own beliefs, identity, feelings or habits of thought, of the factors that affect these, or of changes in these areas, with or without using the words “self” or “awareness”, or their grammatical variants:

> Violet: Yeah, I think, these five lessons, they are still in my head, it’s a bit more fresh, and I learned something. So when I doing my research, it reminds me of like, OK, I have those [barriers], and then try to be aware of that
>
> Dandan: I always think it’s hard when you ask “why?” My thinking not deep, you know, always. It’s very shallow, to be honest
>
> Olivia: This course offers me a chance to rethink my life experience and identify myself. For example, "individualism" is a term I knew by definition but never put myself in a situation to think whether I'm an individualist or collectivist. Same as "future discounting" even though I'm an economics student
>
> Max: I guess that sometimes, if when we face the specific issues, and we need to focus on the bias, and focus on – when we assess the risks, and we should be more care about the factors, like the optimism, and future discounting, and availability bias, and bystander effect
>
> Sam: I think it’s more about avoid ... the influence by your instinct, or something like that, like framing

Critical thinking as a process

Items in this category may also appear in other categories, such as "difficulties and challenges" or "deeper understanding of critical thinking". An item is categorised under "critical thinking as a process" if it follows one or more of the following rules:

The item refers to changes to the participant's conception of critical thinking:

> Olivia: So before that I think the bad thing, so that makes me swing all the time, but for now I don't think like you have one opinion for the whole life, that's critical thinking

The item refers to the participant's attempts to develop critical thinking:

> Ayşegül: I come this course to increase my critical thinking
>
> Helen: Yes, I come because I know everybody said critical thinking is important, right, but I want to learn how to implement it, because sometimes we know but we don't know how to do [all agree], so if somebody can break down the concept, because the concept is too abstract, so I need a concrete steps, like how to – because our brain, need to train our brain
>
> Robin: Yes, it's just from the beginning, I told, I mean you can make it more [says a word in Chinese, which Helen translates] familiar, and you after that maybe you can control a little bit critical thinking ... you can feel, "Oh, this is critical thinking", that "It's my critical thinking", and I can write it

The participant talks refers to perceived changes or improvements in their critical thinking:

> Melina: [My critical thinking is] getting better
>
> Lohita: Before this, my critical thinking was very narrow. And it's particular to what I believe. But after this workshop, as each workshop covers, my thinking starts to develop from narrow to the broad mind
>
> Cyan: Yes, definitely it's changed … I didn't consider anything about critical thinking, I didn't know what is critical thinking, before I came to the UK. And I can find something, I mean, the thought [indicating "thinking" by rotating a finger by his head], sometime it become weird, but I don't know why

The participant talks about difficulty, pain or confusion while developing critical thinking (see the Analysis chapter):

> Violet: … now I know more about, like, the definition [of critical thinking] or beyond that, your frames and bias, so like you more aware of like, why is this hard, or difficult to have critical thinking? It's not just like [snaps fingers] I want to do this and I instantly have that ability

> Olivia: The content of this course has introduced me to an unfamiliar world which was painful at the beginning since so much confusion stuck in the head that needs to clear up. But I can see the benefits of practicing critical thinking skills. I would really appreciate more critical thinking related courses as I find this skill is significant for not just academic study but also in life

The participant frames critical thinking as a journey or as a long process (see the Analysis chapter):

> Robin: From my perspective, I think critical thinking is a process for me…. critical thinking is long away, but I'm on the way!

Critical thinking applied to study

Items in this category may also appear in other categories, such as "argument building" or "independence and initiative". An item is categorised under "critical thinking applied to study" if it follows one or more of the following rules:

The item contains the word "study" or "studies", in relation to critical thinking:

> Abda: Before I come to the course, I was thinking critical thinking is related to the study only

The item contains other words or phrases related to study, such as "essay", "article", "education", or "academic", in relation to critical thinking:

> Max: It is important to our further education and logical thinking (Pre-Course Task)
>
> Olivia: The first thing is the framing. [Kathy: Yeah]. I never think things in that way. Although we have essays, we have to discuss a question in different aspects, I never see it like framing
>
> Agnes: [Critical thinking is] when we read an article, we should analyse it critically instead of just accepting the author's idea automatically. Also, when we using critical thinking to write, we need to provide evidence to support our opinions and make an academic argument (Pre-Course Task)
>
> Sophia: … we should use these kinds of skills intentionally to improve our learning skills or to improve our work

Critical thinking applied to life

Items in this category may also appear in other categories, such as "independence and initiative". An item is categorised under "critical thinking applied to life" if it follows one or more of the following rules:

The item contains the word "life" or "lives", in relation to critical thinking:

> Abda: But then now, I realise critical thinking is related to all our life also
>
> Helen: Yeah, me too, so I think I just start learning, and I think we need to practise in everyday life. So just our study life, not only in this year, postgraduate year, but also in our working area, when we are in our working location, we use critical thinking in our occupation, then it might be very useful, I think

The participant talks about a situation where critical thinking is applied to life outside study or work, without necessarily using the word "life" or "lives":

> [Olivia's earthquake story, see "independence and initiative" above]
>
> Helen: Great. Because I – in my opinion, my own perspective, I think critical thinking can make a nation become more stronger. [Robin: Yeah] Because you can fix some loopholes ... you can fix some gap. [Both agree]. And fix the bad regulations, or the laws, like the laws is very bad for somebody, then we help them to fix – amend the law

Critical thinking applied to work

Items in this category may also appear in other categories, such as "culture". An item is categorised under "critical thinking applied to work" if it follows one or more of the following rules:

The item contains the word "work" or its grammatical variants, in relation to critical thinking:

> Helen: when we are in our working location, we use critical thinking in our occupation, then it might be very useful, I think [General agreement]

The item contains other words or phrases related to work, such as "employee", "boss" or "meeting":

> Helen: However, I think the Chinese boss, the Chinese, uh, enterprise, not enterprise – the, uh, employer, they don't like critical thinking employees, because they think, oh you are very difficult to control. Right?
>
> Sophia: I think it's also very useful in meetings. Yes, you can listen and thinking, what other people say, why the person say in this way, who he is, and what he want to do, what he support, or what he disapprove of. That's very useful

Neutrality or objectivity

Items in this category may also appear in other categories, such as "multiple perspectives" or "deeper understanding of critical thinking". An item is categorised under "neutrality or objectivity" if it follows one or more of the following rules:

The item contains the word "neutral" or "objective", or their grammatical variants:

> Mary: [Critical thinking is t]hinking objectively and fairly with no bias (Pre-Course Task)
>
> Dandan: Actually, I don't change my mind about this, but I have more additional thinking. For critical thinking, be more neutral point

The participant talks about avoiding bias or being aware of the effects of emotion on thinking:

> Sam: but now I think critical thinking is about … avoid bias or focus on the fact, not influence by your emotion
>
> Olivia: Last but not least, this course builds my awareness of some human nature and emotions (such as optimism, risk aversion, availability bias, the bystander effect) that might influence my decision-making process or result in learning with prejudice

The participant seems to be talking about a single, incontestable truth:

> Max: And we should think more about the, mmm, the truth? The truth or the issue itself.
>
> Dandan: [people] think, oh, this is good, but some people from negative perspective, they think this is bad. But the truth is not depend on this or this, their perspective, their views. The truth is the truth

Problem solving

Items in this category may also appear in other categories, such as "multiple perspectives". An item is categorised under "problem solving" if it follows the following rule:

The item contains the words "problem" or "solve" or their grammatical variants, in relation to critical thinking.

> Abda [critical thinking is t]hinking in different way and find alternative solution for each problem aspects (Pre-Course Task)

Logic

Items in this category may also appear in other categories, such as "argument building". An item is categorised under "problem solving" if it follows the following rule:

The item contains the word "logic" or its grammatical variants, in relation to critical thinking:

> Sam: [Critical thinking is to] think following the rules of logic (Pre-Course Task)

<u>Climate change</u>

Concern in participant about climate change

Items in this category may also appear in other categories, such as "personal action on climate change". An item is categorised under "concern in participant about climate change" if it follows one or more of the following rules:

The participant says that they "care" or "do not care" about climate change, using these words or synonyms:

> Olivia: I don't really care about the climate change
>
> Joy: … climate change has no significant impact on my life. Therefore, I usually do not pay much attention to climate change (Pre-Course Task)
>
> Cyan: [I c]are about it more than before

The participant says or implies that climate change is a "problem" or requires a "solution"; is "dangerous", "bad" or "important"; or "seriously" affects humans or the planet; using these words, their grammatical variants, or their synonyms:

> Abda: Climate change is a result of ... global warming, which is the biggest problem [that] threatens our world (Pre-Course Task)
>
> Hilary: Very dangerous to human beings (Pre-Course Task)
>
> Ayşegül: … the effect of human is really terrible on climate change (Pre-Course Task.
>
> Oliva: I hope we can do as much as we can to prevent this issue getting worse (Pre-Course Task.
>
> Max: … climate change would affect our life seriously (Pre-Course Task)
>
> Max: … And I guess at first we should consider the causes, what the climate change lead to, and how we can improve it, how we can solve it, and the solutions

The item contains a reference to excess or imbalance in relation to climate change:

> Sam: I think the earth is like a delicate eco-system ball, which has a stable circulation of wind, land movement and water flows. But [in] recent years, it has … taken too much changing of heat or air composition by human activities (Pre-Course Task)
>
> Yaling: We are doing some activities that influence the climate and using technology to manipulate weather so the climate is kind of losing balance

The participant claimed to be concerned about climate change before the course, and says after the course if they feel the same:

> Sam: I will keep the same idea about climate change. It's a big thing
>
> Olivia: I changed the first sentence. [Kathy: OK the first sentence]. I change my mind for the first sentence, we do as much as we can [Olivia goes on to explain, somewhat circuitously, that she only pretended to care about climate change in the Pre-Course Task because of social pressure to do so]

The item includes attempts or intentions to address climate change or other environmental problems. (NB, participants sometimes conflate climate change with other issues: see "participant's knowledge about climate change" below):

> Lohita [In answer to the interviewer's question about her feelings about climate change]: Yeah, I think I've always been the person who supports doing the things which is friendly to the environment. I use less plastics in my home. Everything is glass things, glass containers, I try to pack all the waste plastics in a separate thing so they can recycle it easily

> Cyan: I don't think I can do some useful or helpful thing for the environment. But if someone or some organisation will suggest or advise all of us do something, I will participate positively, actively!

Personal action on climate change

Items in this category may also appear in other categories, such as "concern in participant about climate change" or "concern in others about climate change". An item is categorised under "personal action on climate change" if it follows one or more of the following rules:

The item refers to actions that the participant or other individuals already take, or might take, to address climate change, whether or not the participant specifies, or approves of, these actions:

> Sam: There are a lot of experts that are dealing with this problem … But it still need our [gestures round the table] efforts
>
> Robin: I want to join encourage more persons to join this campaign, climate change campaign, to do that, to provide [protect?] our planet and make it better
>
> Yaling: If we like, take too serious about climate change, we are too fear about climate change, the best way is we close the [gesturing at the ceiling], close the, uh, turn off the light, and turn off the phone, and just stay here, or maybe it is better to kill ourselves [makes a cut-throat gesture, Abda and Sam laugh] so we cannot breathe [Abda: Exactly, exactly, exactly] we don't consume the air

The item refers to other people's failure to take personal action to address climate change:

> Agnes: I didn't realise the gap between what the researchers, the government said and what people do, so I learned something about that this time
>
> Helen: but seldom people do something, just make action, and everybody just like blind, and oh [hand in front of face] we know it and we ignore it, just like OK because we can go to drink the Starbucks coffee and OK we can go to eat Mr Donald [McDonald's] and OK watch the Pikachu Detective, and we just ignore, a very dangerous thing

Concern in others about climate change

Items in this category may also appear in other categories, such as "personal action on climate change". An item is categorised under "concern in others about climate change" if it follows the following rule:

The item refers to other people's concern about, or awareness of, climate change, or lack of it:

> Dandan: I think maybe people in [Norway] … will not care about the climate change because their country you know developed and they live in a good environment
>
> Jean: Therefore, if people still do not have the awareness, the world will destroy one day
>
> Helen: It's too late. I think, yeah, because the temperature rising, it's gradually, gradually rising, and in our Mandarin Chinese slang, it's like, you cook the frog, in warm water, in a pot, because it's not hot, it's only warm, so nobody feels it's urgent

Climate change as a collective problem

Items in this category may also appear in other categories, such as "awareness of different views of climate change". An item is categorised under "climate change as a collective problem" if it follows one or more of the following rules:

The participant says or implies (for example by using "we" or "our") that the responsibility for addressing climate change should be shared amongst individuals or citizens:

> Rose: It cannot be changed by one or two people (Pre-Course Task)
>
> Ayşegül: Because some people can use climate change in the political, is a good way, or we have good standards and this is the result of our good lives, others can say as a political ... we destroy our futures

The participant says or implies that climate change is a national or global responsibility or threat:

> Abda: Climate change is a result of ... global warming, which is the biggest problem [that] threatens our world. Global authorities should take it seriously and find solutions for this (Pre-Course Task)
>
> Max: … and this include the governments and the specific action and laws. And another things is the co-operation between the different countries

Conversely, the participant says or implies that the responsibility for addressing climate change need <u>not</u> be shared by all individuals or all nations:

> Olivia: So, I don't really care, and … I think those people who suffer from the climate change live really far away from me

> Olivia: I hope we can do as much as we can to prevent this issue getting worse. However, considering the situation in my country, China, the priority now is to create more job opportunities and reduce poverty. So sometimes we have to sacrifice some environment and natural resources for economic growth

Climate change in social and public discourse

Items in this category may also appear in other categories, such as "awareness of different views of climate change" or "climate change as a collective problem". An item is categorised under "climate change in social and public discourse" if it follows one or more of the following rules:

The participant says or implies that the topic of climate change does or does not occur frequently in private conversation or in the media:

> Dandan: Climate change is a hot topic around the whole world, and it is an serious issue also, this word appears almost everywhere
>
> Joy: [the topic of climate change is] more frequently in IELTS or TOEIC, I mean like these English tests, articles, rather than newspapers
>
> Jean: … when people mentions climate change we think it is a serious problem, but in fact in our daily life, we still don't mention it, yeah, so I think maybe it's not a serious problem
>
> Hamra: Nobody talk about it, to be honest

The participant says or implies that there is peer pressure to take action on climate change:

> Olivia: 'Cause, when we live in the globalism, we have to have the same pace with other countries … people who don't care about the climate change or the earth at all, they have to do some things to, like, keep the same pace with others – peer pressure?

Awareness of different views of climate change

Items in this category may also appear in other categories, such as "personal action on climate change" or "framing". An item is categorised under "awareness of different views of climate change" if it follows one or more of the following rules:

The participant says or implies that different people, organisations or nations have different views of climate change:

> Yaling: There are some different opinions about the climate change. And some departments says it is very dangerous, and we have to change our … daily ways, or something else, and some say, it is nothing
>
> Max: the climate change for the different people, they have different angles … for the students and the policeman and for another peoples in the society, they have their different understanding about this issue
>
> Max: And for the [*unclear*: political?] countries, even they have different understanding of the climate changes? … Like, different countries have its own positions, and their own understanding of this issue

The item refers to different ways to frame climate change (these items may also be categorised under "Framing":

> Ayşegül: I was thinking about climate change before, like the social, not social, it's the environmental, political and economic issue, with this course I learned another aspect, another framing of the climate change
>
> Dandan: And for such as framing, I think I have more, especially for the climate change, economic issue, religious issue, political issue, I don't know about that, but I also know the health issue and this is environmental issue

Participant's knowledge about climate change

In the Methodology chapter on pp. 138-139, I explain how I judged whether participants were displaying knowledge about climate change in these items or not. Items in this category may also appear in other categories, such as "concern in participant about climate change". An item is categorised under "participant's knowledge about climate change" if it follows one or more of the following rules:

The item refers to the causes or effects of climate change, or effective actions to address climate change, that are supported by the consensus of scientific opinion:

> Sophie: I think climate changes a lot from the accumulated reports of news, such as the bears have lost their homes, just because the icebergs are melting. So, extremely temperature was reported at the same time point during different times
>
> Ayşegül: Climate changing is normal because there is a science history of climate but the effect of human is really terrible on climate change. We change it unpredictable way (Pre-Course Task)

The item refers to the participant's beliefs about climate change that are <u>not</u> supported by the consensus of scientific opinion:

Dandan: As far as I am concerned, climate change has a deep impact in some countries … However, climate change may effect people in cities in developed countries [*unclear*: lighty?], because it's nothing more than a hot or cold climate (Pre-Course Task)

Helen … I think I remain some doubts about the cause, just like, is it really the pollution cause the climate change, or it was a normal process of the earth growing … 4.6 billion [years] ago, when the earth was born, right, and you can see the scientists' statistics the temperature of the earth goes high, sometimes goes low, goes down, so it's like naturally. So I just feel doubts that is that really the C02 caused the climate change?

The participant refers to their own lack of knowledge about climate change:

Cyan: Not everyone have a climate change background, not everyone can understand the difficult issues about climate change

Violet: Yeah, I just hadn't, kind of, very few ideas about climate change

Sophie: … I need to see the different data during different time, and different years, to convince. So, how the climate change or in what kind of way it is changing. Maybe I need more to read, to convince

The participant says or implies that they have learned something about climate change in the workshops:

Hamra: when we join the course, and we look at the different aspects and the real danger of the climate change

Lohita: So, after this workshop, I get to understand what is going on in the present about the climate change

Portia: … before I just think climate change is the temperature rising, and it has a lot of disasters, and now I know it has a lot of things in it

Appendix 5

Ethical approval letter

Approved: 13/12/2018

Kathryn Aston

Registration number: 160102486

School of Education

Programme: Doctorate in Education

Dear Kathryn

PROJECT TITLE: Exploring barriers to critical thinking with students of English for Academic Purposes, using the topic of climate change.

APPLICATION: Reference Number 023437

On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that on 13/12/2018 the above-named project was **approved** on ethics grounds, on the basis that you will adhere to the following documentation that you submitted for ethics review:

University research ethics application form 023437 (form submission date: 21/11/2018); (expected project end date: 20/12/2019).

Participant information sheet 1052615 version 3 (21/11/2018).

Participant consent form 1052616 version 2 (21/11/2018).

If during the course of the project you need to deviate significantly from the above-approved documentation please inform me since written approval will be required.

Your responsibilities in delivering this research project are set out at the end of this letter.

Yours sincerely

David Hyatt

Ethics Administrator

School of Education

Please note the following responsibilities of the researcher in delivering the research project:

The project must abide by the University's Research Ethics Policy:

https://www.sheffield.ac.uk/rs/ethicsandintegrity/ethicspolicy/approval-procedure

The project must abide by the University's Good Research & Innovation Practices Policy:

https://www.sheffield.ac.uk/polopoly_fs/1.671066!/file/GRIPPolicy.pdf

The researcher must inform their supervisor (in the case of a student) or Ethics Administrator (in the case of a member of staff) of any significant changes to the project or the approved documentation.

The researcher must comply with the requirements of the law and relevant guidelines relating to security and confidentiality of personal data.

The researcher is responsible for effectively managing the data collected both during and after the end of the project in line with best practice, and any relevant legislative, regulatory or contractual requirements.