



# The Effectiveness of the Use of L1 in EMI Courses on Disciplinary Knowledge Acquisition in Higher Education in China

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## Abstract

This study investigated the effectiveness of L1 use in EMI classrooms on students' disciplinary knowledge acquisition. With the widespread implementation of EMI programs across the globe, language use in EMI classrooms has been a topic of great interest. In this study, a total of 19 university students with high English proficiency were recruited from a Chinese university. The comparison group ( $n = 9$ ) received 15-minute English-only instruction, while the experimental group ( $m = 10$ ) received 15-minute instruction delivered in both English and Chinese. Both groups were taught by the same teacher, and the course content was the same. All participants' mastery of content knowledge was assessed by a post-test and a delayed post-test. It was found that the two groups performed equally well, and L1 use did not significantly affect students' content learning and knowledge retention ( $p > 0.5$ ). Additionally, participants completed a questionnaire to show their attitudes toward L1 use in the EMI classroom and provide reasons for the quantitative results. The findings suggested that L1 use can positively or negatively affect disciplinary knowledge acquisition from different perspectives, such as lecture comprehension and classroom engagement.

# **1. Introduction**

## **1.1 Research Background**

It is widely acknowledged that the use of English as a medium of instruction (EMI) has spread throughout various educational contexts worldwide because of the prominent role that English plays in various sectors, not limited to academia (Macaro, 2018). The global use of EMI in higher education has been described as “the most significant current trend in internationalising higher education” by the director of the English language at the British Council (Parr, 2014). EMI is portrayed as *killing two birds with one stone*, since it allows for the simultaneous achievement of subject matter delivery and English language improvement. As a result, EMI has been introduced to many universities worldwide and is expanding at a rapid pace (Wächter & Maiworm, 2014). In such light, various kinds of EMI programs emerged, and students’ native language (L1) was used in the EMI classrooms instead of creating an English-only environment. However, there is no consensus on language use for content learning in EMI settings, and the effectiveness of L1 use on disciplinary knowledge acquisition is controversial due to the lack of empirical studies.

## **1.2 Research Aims and Research Questions**

The present study aims to explore the effects of L1 use on students’ disciplinary knowledge acquisition based on both quantitative data from test results and qualitative data from questionnaires. By doing so, this study aims to contribute to the small body of empirical research on language use in EMI classrooms and provide a more comprehensive understanding of L1 use in EMI settings for classroom practice.

In a review of previous research on the implementation of EMI programs, the following two research questions that guide this study are proposed to achieve the objectives mentioned.

1. What are the differential effects on the acquisition of content knowledge of L1-mediated learning compared to English-only learning?
2. What are students’ perceptions about the influence of the use of L1 in the intervention on disciplinary knowledge acquisition?

By answering these research questions, the study hopes to shed some light on future directions in this field.

### **1.3 Dissertation Structure**

The dissertation is organized as follows.

Chapter One is an overall introduction of the research background, research aims and objectives, and dissertation structure. Chapter Two reviews previous theoretical and empirical studies on EMI programs and L1 use in EMI classrooms. The research gap found in this chapter is the basis of this study. Chapter Three proposes the methods used for this study, including the research design, participant recruitment and allocation, research procedure, data collection and analysis, and ethical considerations. Chapter Four presents the results based on the test scores and questionnaire answers. Chapter Five summarizes the findings and compares them to other relevant literature. Chapter Six concludes the major findings of the study, points out the limitations, and suggests possibilities for future research.

## **2. Literature Review**

This chapter provides an overview of the development of EMI and existing studies on language use in EMI classrooms to situate the current research on L1 use in EMI settings and its impacts on the dual aims of EMI programs. This chapter also explains how the research questions and the experiment were designed.

### **2.1 The Definition of EMI**

As a relatively burgeoning field of academic teaching, the definition of EMI remains unclear and has yet to be universally agreed upon (Airey, 2016). According to Dearden & Macaro (2016), EMI is “an umbrella term for academic subjects taught through English, one making no direct reference to the aim of improving students’ English” (p. 456). Similarly, Brochier (2016) defines EMI as “teaching subjects using the English language without explicit language learning aims and usually in a country where English is not spoken by a majority of the people.” These definitions are open to dispute, and there are other definitions of EMI proposed by scholars based on different interpretations of EMI (Brown & Bradford, 2014). Several reasons could account for the lack of consensus on EMI definitions.

One reason for the dispute over the definition of EMI is that English is hard to define in a global sense because of its rich local varieties in its outer and expanding circles (Jenkins & Mauranen, 2019). Another reason for this ill-defined concept is that EMI definitions encompass a variety of practices and are heavily context-dependent. In different EMI cases, the use of English as the medium of instruction can vary enormously, from English as the sole language of instruction to its use alongside students’ first language (L1) or to the minimal use of English that is limited to specific classroom performances and translations (Hu, 2008). As for entire EMI programs, EMI can refer to programs where all courses are taught in English to varying degrees or programs where some courses are delivered in English while others are taught in students’ L1 within the same program (Macaro, 2018). The different ways of EMI implementation reflect the ambiguity in EMI definitions.

Another debate about EMI definitions is concerned with whether the current definitions of EMI are too narrow by excluding English-medium educational practices in Anglophone settings (Rose et al., 2023). For instance, Pecorari and Malmström (2018) argue that EMI should be interpreted more broadly to include “contexts in which English is a dominant language and in which English language development is supported and actively worked for” (p. 507). However, some experts contend that although it is acknowledged that international Anglophone universities face similar issues to global institutions, expanding EMI definitions unconditionally to include all these types of education in English could blur the lines between EMI-specific issues and broader educational concerns (Rose et al., 2023).

In addition, it was found that the definitions of EMI are inconsistently applied across different regions, such as its use in Hong Kong but not elsewhere. Sometimes EMI is even confused with “Content and Language Integrated Learning (CLIL).” Macaro’s (2018) studies revealed diverse labels for EMI, including “English medium instruction education,” “English as a lingua franca,” “parallel-language education,” and others without a clear justification. The term “Content and Language Integrated Learning” was used in 12 out of 83 studies because teachers were asked or encouraged to integrate content and learning based on institutional policy. These terminological and practical inconsistencies could reflect the fluidity of EMI definition and implementation.

Among diverse definitions, a generally accepted one is that EMI refers to “the use of the English language to teach academic subjects (other than English itself) in countries or jurisdictions: where the first language of the majority of the population is not English” (Macaro, 2018, p. 19). In this dissertation, for the purpose of analyzing the effectiveness of the use of students’ first language (L1) in EMI settings, this well-recognized definition was used as the working definition.

## **2.2 The Development of EMI in Higher Education**

### **2.2.1 The Rise of EMI**

Globalization appears to be inevitable and fast-growing, creating a new global order that is exerting an unprecedented impact on societies. Against this backdrop, many universities responded to globalization by promoting internationalization, making it a crucial part of the development of higher education globally (Altbach & Knight, 2007). In addition, because the trend of deepening globalization underscores the dominance of English as a global lingua franca in the past few decades (Van Parijs, 2011), English is expanding rapidly as a teaching language in higher education and is widely used in business, science, and other emerging fields of professional domains (March, 2006). This shift in the medium of instruction means that English is now taught as a vital educational language for non-language academic subjects rather than being taught solely as a foreign language. According to a report from the British Council and the University of Oxford, “There is a fast-moving worldwide shift from English being taught as a foreign language (EFL) to English being the medium of instruction (EMI) for academic subjects” (Dearden, 2014, p. 2). As a result, in the context of higher education in many countries, English as a Medium of Instruction (EMI) has surged as a strategic measure for internationalization in a globalized world (Coleman, 2006; Wilkinson, 2013).

The term emerged in the late 1990s with the changes in European higher education driven by the Bologna Process. This initiative aimed to standardize the degree programs across European universities to enhance academic mobility and employability (Wächter, 2004). However, its popularity soon spread beyond Europe to countries where the national languages have no apparent political connection to English. Across the globe, educational systems have expressed great interest in using English as a medium of instruction, and it has been proven successful in teaching other subjects through a second language in some educational settings (March, 2006).

Significant expansion of EMI has been indicated in large-scale surveys (Wächter & Maiworm, 2014). EMI showed strong development momentum in Europe. By 2007, the number of EMI programs in mainland European universities had increased by 34% compared to 2002, reaching 2,400 programs at 400 higher education institutions. Approximately 7% of

all programs at 2,218 respondent institutions were EMI programs (Wachter & Maiworm, 2014). According to another report by Brenn-White and Faethe (2013), there was a 1000% increase in the number of EMI master's programs provided across Europe in just 10 years, primarily in engineering, technology, economics, and business. This trend of the EMI boom is happening globally and has emerged in East Asian countries, such as Japan and South Korea (Piller & Cho, 2013). In Japan, the number of Japanese universities that provided EMI programs increased by 5% from 2008 to 2010, making up 29.2% of total undergraduate offerings (Chapple, 2015).

### **2.2.2 The Implementation of EMI in China**

This expanding global phenomenon has been seen among East Asian countries, especially China, which strongly advocates EMI education. Due to the increasingly competitive market for higher education across the globe, China has been actively promoting the implementation of EMI at the university level (Hu, 2009b). According to Jiao (2012), offering EMI programs is a strategic plan for internalizing higher education and developing World First-Class Universities in China. Consequently, EMI has become a common practice and has experienced rapid growth in many Chinese universities (Hu & Lei, 2014).

The official promulgation of EMI started in 2001 when China entered the World Trade Organization (WTO), resulting in an urgent demand for a workforce with high English proficiency (Beckett & Li, 2012). To improve the quality of university education and respond to this demand, the Chinese Ministry of Education (MOE) issued a national directive that 5% to 10% of university courses should be taught in English at first-tier universities (Hu et al., 2014). This policy was revised in 2007, calling for 10% of undergraduate credits to be taught in English (Beckett & Li, 2012). To ensure the effective implementation of the initiatives, the Ministry of Education has included the quantity of EMI courses as a crucial criterion for evaluating higher education institutions (Hu & McKay, 2012). In addition, a variety of incentives have also been provided to encourage university lecturers to teach academic subjects in English (Tong & Shi, 2012), accelerating the growth of EMI in Chinese universities. According to a survey conducted by Wu et al. (2010), 132 out of 135 higher

education institutions in mainland China had offered EMI courses by 2006, with an average of 44 offered by each university. In 2007, the implementation of EMI courses was further promoted due to the publication of different national policies, reaching the first peak of institutional EMI documents (Rose et al., 2020). These supporting policies contributed to the boom of EMI programs within a short time and promoted the substantive development of higher education in China.

## **2.3 The Reasons for its Popularity**

### **2.3.1 Driving Forces behind EMI**

The global adoption of EMI in higher education is motivated by several factors (Coleman, 2006). According to Wilkinson (2013), the growth of EMI has been influenced by social, economic, and educational variables from different perspectives.

EMI has always been seen as a means of gaining access to advanced knowledge and boosting national competitiveness, especially in the fields of knowledge production and technological innovation (Kim et al., 2017). That is because English plays a crucial role in transmitting scientific and academic knowledge in higher education. Most terminologies and theories in various academic fields are initially expressed in English, and most academic journals are published in English to reach a broader audience (Byun et al., 2011). In addition, English-version textbooks and reference materials are typically more numerous and of higher quality, and an increasing number of international meetings are held solely in English (Zhang, 2018). Because of the dominance of English in today's global academic market (Altbach, 2004), EMI programs could expose students to cutting-edge knowledge and attract more English-speaking teachers to increase the number of high-quality publications in international academic journals. Consequently, the implementation of EMI in higher education is perceived as a crucial strategy to internationalize universities, which contributes to gaining higher prestige and raising their position in global university rankings (Piller & Cho, 2013).

In addition, the rapid expansion of EMI programs in higher education can also be attributed to a desire to create new sources of revenue (Wilkinson, 2013). On account of the

higher tuition fees of EMI programs, implementing such programs could attract a growing number of international students to generate more revenue for the universities, which is particularly important for some countries that face declining domestic student enrollment due to shifting demographics, such as Japan (Macaro et al., 2018).

From the perspective of students, a variety of personal benefits have led to the current boom of EMI, including English language development, subject knowledge acquisition, global awareness, intercultural understanding, international communication, creativity, and competitiveness in a globalized society (Kassteen 2013, cited in Chapple 2015, p. 3). Among diverse driving forces, greater mobility and better career prospects have been seen as the prime motivations for students (Lueg & Lueg, 2015). EMI is seen as an effective way to prepare students for educational opportunities abroad and international careers (Airey et al., 2017). Many students believe that EMI programs can enhance their employability and help them obtain high-paying jobs in the domestic and global labor markets (Pecorari et al., 2011).

### ***2.3.2 Killing Two Birds with One Stone***

In academia, EMI is often portrayed as “*killing two birds with one stone*, whereby both subject content learning and English language proficiency can be achieved in the same classroom” (Curdt-Christiansen et al., 2023, p. 2). According to Rose and Galloway (2019), many universities highlight the linguistic gains of EMI and expect that “English language proficiency will develop in tandem with subject discipline knowledge” (p. 195). Even though the language learning benefits of EMI programs are not clearly stated in the definition of EMI, research on EMI frequently indicates a dual commitment of EMI (Zhou et al., 2022). Additionally, English language development is sometimes viewed as a “by-product” of learning academic subjects through English (Taguchi, 2014).

The underlying ideology behind these expectations is that learning academic subjects in another language can improve language proficiency. This improvement is achieved through meaningful content that motivates efficient language learning (Swain & Johnson, 1997). It is argued that EMI programs create a favorable learning environment where students are extensively exposed to English and have the opportunities to use English for meaningful

communication and negotiation about content knowledge, leading to more significant linguistic gains and better English acquisition (Hammond, 2016). As a result, EMI has received strong support from numerous researchers, who have contended that EMI is an ideal learning approach to achieve the dual aims of English language learning and disciplinary knowledge acquisition (Coleman, 2006; Smit & Dafouz, 2012).

Considering the gains in both language and subject learning, EMI is seen as an effective way to improve the quality of higher education (Airey et al., 2017). However, such optimistic assumptions are controversial due to mixed findings in empirical studies (Hu & Lei, 2014; Bälter et al., 2023). It seems that the quality of EMI programs is situation-dependent and can be influenced by various factors, especially teachers' and students' English proficiency, which will be discussed in detail in the following section.

## **2.4 The Debates on EMI**

### **2.4.1 Debate on the Impacts of EMI**

Although EMI has gained increasing popularity across the globe, it is still under criticism (Kirkpatrick, 2010). One worry that is being increasingly expressed about the rapid spread of EMI courses in higher education is the risk of English bias and its negative impacts on the home language (Cason & Rodriguez, 2013). As Belhiah and Elhami (2015) argued, more research is needed to investigate the impacts of EMI expansion on L1, which may threaten the status and importance of knowledge and academic papers produced in the national language, leading to potential linguistic and social consequences. According to Kırkgöz's (2005) study of 203 university students, it was found that one adverse effect of learning academic subjects through another language is that it brings about "the feeling of being distanced from their native language and culture" (p. 101). As a result, EMI is sometimes rejected to avoid the risks of L1 attrition and to protect national identity. For example, EMI has been banned in public education in some countries like Israel, Senegal, and Venezuela (Dearden, 2014). Additionally, at the beginning of the 21<sup>st</sup> century, Chinese scholars expressed concern about the status of Mandarin as the medium of instruction in higher education and opposed the

implementation of EMI programs (Ma, 2006). However, many scholars challenged this opinion and argued that as long as the domains of L1 are well maintained and employed, the use of EMI in higher education will not affect the dominance of L1 and will not result in the loss of the native language in favor of English (Zhang, 2018). Instead, implementing EMI programs can contribute to the acquisition of global linguistic competence and prepare students for a globalized society (Taguchi, 2014).

Another debate centered on the inequality in higher education, which is caused by the growing trend of implementing EMI programs in non-Anglophone countries, referring to the unequal opportunities to learn and obtain academic success among university students with different levels of English (Alhamami, 2023). In some non-Anglophone countries, proficiency in English is a requirement for admission to many universities, which may result in unfairness for students from lower socioeconomic families who are less likely to speak English fluently due to fewer educational resources than others (Sah & Li, 2018). This is because only when students learn academic subjects through their L1 or a foreign language that they speak like native speakers can they have equal rights to acquire knowledge without barriers (Babaci-Wilhite, 2016). Consequently, this kind of injustice aroused researchers' concern to re-evaluate the implementation and effectiveness of EMI programs. However, it was found that it is difficult to find published papers that emphasize the issue of unfairness in higher education caused by EMI, which means that more in-depth research is needed to explore and minimize this negative effect for more equitable implementation of EMI.

#### **2.4.2 Debate on the Effectiveness of EMI**

Although EMI has been widely promoted by governments and universities for its dual aims of subject matter delivery and English language learning, which is often portrayed as "*killing two birds with one stone*," there is increasing disagreement over the extent to which disciplinary knowledge acquisition and English language development occur (Macaro et al., 2018). Räsänen and Klaassen (2006) claimed that EMI teachers underestimated the detrimental effects that English as a foreign language will have on students' mastery of

content knowledge in EMI settings. Based on the inconsistent results of empirical studies, the effectiveness of EMI has been shown to be less than ideal for several reasons in most cases.

#### **2.4.2.1 English Language Development**

The existing research has produced mixed results and inconclusive findings about the effectiveness of EMI programs in improving students' English proficiency. While some studies have shown that EMI programs facilitate language learning (Aguilar & Rodríguez, 2012; Wilkinson, 2005), other studies have found no significant difference in English competence between EMI students and those students who took courses in their L1 (Hu & Lei, 2014; Yang, 2015).

It is well recognized that the extensive exposure to the English language that EMI programs provide may facilitate enhancing English competence (Pecorari et al., 2011). EMI classrooms can offer a naturalistic English-immersed environment, which is a favourable environment for students to practice their English skills in various academic settings when they are encouraged to use English for meaningful communication and interaction with teachers and classmates, such as in Q&A sections and group discussions, thus improving their listening and speaking skills (Tatzl, 2011). According to a survey conducted by Sarkar et al. (2021) in private universities in Bangladesh, one positive consequence of EMI was identified as linguistic gains, particularly in speaking. The benefits of EMI were also mentioned in relation to the development of English communicative skills. In addition, the emphasis on content-based learning in EMI programs necessitates that students interact with course materials in English, giving them access to high-quality English input in class. EMI programs require students to review textbooks and course materials before class for lecture comprehension, thereby improving their reading skills (Tran et al., 2021). Rogier's (2012) study in the United Arab Emirates included 75 female undergraduate students between 22 and 35 years old and 433 full-time faculty members at the university. Students took two IELTS tests at university entry and exit, and both students and staff completed a questionnaire and participated in an interview. The results highlighted a notable improvement in English proficiency among 59 undergraduate students, whose overall IELTS band score increased

after four years of study in the EMI classroom. In this study, the use of a retrospective panel study design with a test method over four years allows for the observation of English proficiency development over time, providing more reliable data on language gains. However, the study did not include a control group of students for comparison, which made it challenging to account for confounding variables that might influence the outcomes. In addition, this study focused only on female students, which might not represent the experiences of male students.

Some other studies have supported the positive effects of EMI programs on language learning, indicating that students in EMI courses made greater linguistic progress than those attending traditional educational programs (Lin, 2006; Lo & Murphy, 2010).

However, some existing studies showed that EMI programs may be ineffective when it comes to facilitating English development (Chapple, 2015; Yang, 2015). The results indicated that EMI programs may not have any significant effects on language learning, and students may not achieve notable improvements in their English skills through EMI programs as anticipated. In Hu and Lei's (2014) study, 136 students (45 males and 90 females, with one not reporting gender) who had studied English for at least six years prior to university admission were involved. 64 students were from the English medium instruction (EMI) program and 72 were from the Chinese medium instruction (CMI) program. Students' English proficiency was measured using the College English Test Band 6 (CET6), while affective responses were measured through an adapted questionnaire and a follow-up interview. This study found that, after a one-year study of EMI, EMI students did not perform better than their CMI peers on the CET-6 test despite accounting for other variables. Additionally, EMI students did not show more positive attitudes towards learning or using English. These findings implied that EMI programs may not enhance students' English competence, which worked against idealized assumptions about the benefits of EMI. However, several possible explanations should be considered for these results. On the one hand, the amount of EMI provided in the study may be insufficient to produce discernible impacts. On the other hand, there was a potential mismatch between the English proficiency tested in this study and the type of skills that EMI targeted. While CET6 mainly focuses on linguistic knowledge, EMI may concentrate on students' communicative skills in a meaningful context.

Based on the mixed findings, it can be concluded that the language barrier is one major obstacle that prevents students from receiving rich English input in EMI classrooms for language learning. On the one hand, some teachers in EMI classrooms who are non-native English speakers found it challenging to teach their subjects solely in English (Kim & Yoon, 2018). On the other hand, students with limited English competence reported difficulty comprehending the lecture content (Soruc et al., 2021). As a result, some teachers may purposefully switch to using their L1, which is also the first language of students in EMI classrooms, to explain concepts and provide examples to ensure clarity and understanding. In a survey by Tong and Tang (2017), first-year Chinese undergraduate students in an EMI calculus class were involved. There were two rounds, each with a 90-minute class time and a 10-minute break. The results revealed minimal use of English in the EMI classroom, with 67% of the class time spent in Chinese and 23% in a mix of Chinese and English. Another study conducted by Sarkar et al. (2021) in Bangladeshi private universities found that Bangla was frequently used alongside English to address critical questions, and some teachers tended to respond in Bangla for a better understanding. One interviewee reported that “they speak Bangla more than English.” It appears that English may not even be the primary language as a medium of instruction in EMI classes, let alone being the only one. Additionally, Macaro (2019) argued that some teachers have the tendency to employ L1 to grab students’ interest and make the connection between subject matter and their culture for subject learning. As a result, the choice of reverting to L1 could make students’ exposure to high-quality English input far less than what is expected of EMI courses, limiting their linguistic gains and working against the aim of EMI programs.

#### **2.4.2.2 Disciplinary Knowledge Acquisition**

According to the literature, studies on the effects of EMI programs primarily focused on English language development, with less attention given to disciplinary knowledge acquisition (Tong et al., 2020). Among the empirical research, mixed findings have been reported about the impacts of EMI on subject learning.

Badrie and Abir's study (2018) investigated how CLIL affected undergraduate students' (n = 21) performance in math tests at a Lebanese university. The higher scores on the post-test compared to those on the pre-test indicated that the implementation of CLIL greatly improved students' academic achievements. However, the absence of a direct comparison group of students taught in their first language made it impossible to determine if these gains were directly attributed to CLIL. In Joe and Lee's (2013) study, 61 Korean first- and second-year medical students (36 males and 25 females) from a required medical course at a university in Seoul were involved. The procedure included a 10-minute pre-test in Korean, two 50-minute lectures (one in English and one in Korean) on different clinical classes, and a post-test in the respective lecture languages. The results revealed similar comprehension levels for both English and Korean lectures, with no significant impact of students' general English proficiency on their understanding or final grades. The study did not detail whether the course materials were similarly designed between the English and Korean lectures. Ensuring that all teaching materials are equivalent in complexity and quality is crucial for a fair and valid comparison. Despite these limitations, this study suggested that EMI may have no negative effects on content learning, corroborating with several other studies (Bryan & Habte-Gabr, 2008; Park, 2007; Aizawa et al., 2023).

However, detrimental effects of EMI on disciplinary knowledge acquisition have been reported in other studies (Dafouz et al., 2014; Zaif et al., 2017; Hellekjær, 2010). In the study conducted by Bälter et al. (2023), 2,263 participants (a convenience sample) were randomly assigned to either Swedish-medium instruction (SMI) or EMI. Both versions of the course were identical, except for the language of instruction. Participants' academic performance was measured using test scores and retention rates. The findings indicated that SMI outperformed EMI students in academic knowledge acquisition with higher retention rates. However, the reliance on self-assessment for English proficiency may introduce subjective bias. There is also a limitation in sample characteristics, such as the exclusion of students who swapped courses during the experiment. Moreover, potential confounding variables, such as students' motivation, cannot be entirely eliminated in this study, which could influence the results. Nonetheless, this study sheds light on the potential negative consequences of EMI on academic performance. In addition, Hellekjær's (2010) study reported the comprehension

difficulties experienced by a large number of EMI students, suggesting the challenges of content learning in EMI classrooms.

Among the empirical research, despite conflicting results about students' academic knowledge mastery, many studies have demonstrated that EMI may have an adverse impact on students' acquisition of disciplinary knowledge (Zumor & Qasem, 2019). Therefore, many studies have been conducted to investigate the reasons for such negative effects and improve the effectiveness of EMI programs.

From the perspective of students, their insufficient mastery of subject matter could be explained by their poor understanding and involvement in EMI classrooms. According to Troudi (2009), learning academic subjects in a second language can be cognitively challenging for students, especially those with limited language proficiency. In terms of lecture comprehension, Hellekjaer (2010) found that some students had great difficulty understanding the course content due to their unfamiliarity with certain English words. In this way, students needed extra time to follow the lecture, and sometimes they might miss part of the lecture, which had an adverse effect on their content learning. According to the study by Shaw et al. (2008), testing indicated that students had a more superficial understanding of the subject matter when English was used as the medium of instruction in class. In terms of students' participation, it was discovered that the students' questions in EMI classrooms were fewer and simpler compared to those in traditional courses taught in L1 (Shaw et al., 2008). Similar findings were observed in the discussion in EMI classrooms. Students tended to participate less in EMI classroom interaction as they found it difficult to organize their ideas and communicate course content in English with others (Zumor & Qasem, 2019). Consequently, insufficient and low-quality classroom interaction could result in unsatisfactory learning outcomes.

From the perspective of teachers, students' disciplinary acquisition has suffered in EMI classrooms due to the reduced quantity and quality of course content. Many studies have found that, compared to traditional courses delivered in L1, the subject matter taught in EMI classrooms is often simplified (Vinke et al., 1998; Jiang et al., 2019). Because of teachers' inadequate English skills and the high linguistic demand of EMI programs, EMI teachers found it challenging to teach the same amount of academic knowledge in English as they

could in L1 courses (Hincks, 2010). According to Thøgersen and Airey's (2011) study at a Danish university, the speaking rate in the EMI classrooms was slowed by 23.4%, and the course content was reduced by 21.5%. In addition, EMI teachers reported having difficulty using English to explain complex terms and concepts (Pun & Thomas, 2020). Therefore, some teachers tended to cover only the basic subject matter and avoid elaborating further on it, resulting in a decrease in the quality of EMI courses (Hu & Lei, 2014). 99% of Chinese students who were interviewed in the study conducted by Beckett and Li (2012) complained that "content taught in English by Chinese professors is shallow and does not meet their needs" (p. 55). These findings indicated that it is difficult for EMI programs to ensure that students can achieve the same academic success as they can in traditional courses.

#### **2.4.3 Debate on Language Use in EMI Classrooms**

It can be seen from the above that, under some circumstances, EMI may not achieve the optimistically envisioned dual goals of helping students acquire disciplinary knowledge and improve language skills as naturally as expected. Despite the fact that some data were self-reported and challenging to measure objectively, the results did show that a variety of factors can affect the learning outcomes that students receive from EMI programs, particularly the use of L1. In this way, language use in EMI classrooms has gained increasing attention from researchers.

However, it was found that there is a lack of explicit policies and guidelines for teachers about language use in EMI classrooms within higher education institutions, and thus teachers do not know how to implement EMI programs effectively (Dearden, 2014). There was little evidence to suggest that there was a policy dictating whether only English should be used in EMI classrooms or code-switching, which refers to the use of both English and students' L1, should also be permitted (Macaro, 2018), leading to great variations of EMI offerings in higher education (Hino, 2017).

### 2.4.3.1 Pedagogical Translanguaging

In the context of EMI and bilingual education, pedagogical translanguaging has been proposed to incorporate several languages in classrooms (Duarte, 2020), and it has gained increasing attention as it acknowledges the linguistic resources of both teachers and students (García & Li, 2014). Cenoz (2017) defined pedagogical translanguaging as “planned by the teacher inside the classroom and can refer to the use of different languages for input and output or to other planned strategies based on the use of students’ resources from the whole linguistic repertoire (p. 194)”. According to Cenoz and Gorter (2022), pedagogical translanguaging is “a pedagogic theory and practice that refers to instructional strategies that integrate two or more languages (p. 10)”. In EMI or bilingual classrooms, pedagogical translanguaging supports learning by “making meaning, shaping experiences, understandings, and knowledge through two languages (Baker, 2011, p. 288)”. He argued that both languages are used in a systematic and integrated way to organize and facilitate cognitive processes involved in learning, providing a “deeper and fuller understanding of the subject matter (Baker, 2003, p. 82)”.

One important theory related to translanguaging and L1 use in bilingual classrooms is the Linguistic Interdependence Hypothesis proposed by Cummins (1979). This hypothesis assumes that one’s ability to learn a second language (L2) is partially influenced by their level of proficiency already attained in L1. According to this hypothesis, the acquisition and use of L2 can be facilitated by the transfer of abilities, knowledge, and cognitive processes from L1 to L2, indicating an interrelation between underlying linguistic and cognitive skills in both languages.

Many studies have examined the use of L1 in EFL (English as a Foreign Language) contexts, showing different findings. In Abdulaal’s (2020) study, participants were allocated either to an English-only group (n = 30) or to a translanguaging group (n = 33). The results indicated that the translanguaging group significantly outperformed the English-only group in the IELTS exam. The findings supported the positive effects of using L1 in bilingual classrooms, corroborating with other studies (Tang & Peng, 2020; Yasar Yuzlu & Dikilita, 2022). On the contrary, some other studies showed that there was no statistically significant

difference in the test scores between a translanguaging group and an English-only group (Hopp & Thoma, 2021; Hopp et al., 2021; Qureshi & Aljanadbah, 2022). However, the empirical evidence is limited and mostly of low quality, which is partly attributed to flawed experiment design, such as the absence of standardized outcome measures (Huang & Chalmers, 2023). Therefore, it was found that little high-quality research could help us determine the actual effects of L1 use.

In the domain of EMI, the development of pedagogical translanguaging represents a shift from complete avoidance of students' L1 to the idea that students' entire linguistic repertoire, especially their home language, should be exploited in teaching to raise their learning outcomes.

#### **2.4.3.2 The Use of L1 in EMI Classrooms**

Some researchers supported and even encouraged the use of L1 in EMI classrooms based on the opinion that the quality of students' subject learning should not be reduced due to the medium of instruction. They argued that excessive focus on English-only EMI courses may risk sacrificing disciplinary knowledge acquisition (Chen et al., 2020). In EMI classrooms, L1 should be seen as a helpful tool for content teaching and learning (Kim et al., 2017; Qiu & Fang, 2022). According to Baker (2011), switching between English and L1 in EMI classrooms involves using the linguistic resources of bilingual teachers and students, which is "cognitively, linguistically and operationally sensible" (p. 229). On the one hand, using students' L1 makes it possible to connect their prior knowledge to new information, which could relieve students' cognitive load and support their learning process (Bransford et al., 2000). On the other hand, the use of L1 suggests a range of practices that serve different purposes in EMI classrooms for lecture comprehension and content learning, such as clarification, elaboration, reiteration, and localized example provision (Moodley, 2007). In addition, Williams (2002) argued that using bilingual resources and switching between two languages in classrooms indicate a high degree of cognitive engagement, reinforcing the understanding of both language and subject matter.

In the study conducted by Plante (1976), a total of 76 Spanish-dominant pupils were involved and assigned to either the experimental group (45 pupils) or the control group (27 pupils). Participants in the experimental group received bilingual education using the Connecticut “Pairing” Model, while the control group did not receive such specialized instruction. The study found significant differences in participants’ academic achievement between these two groups. The experimental group showed higher mean scores in both Spanish and English reading tests and also outperformed the control group in arithmetic and language arts. This study employed various assessment tools to measure different outcomes for more reliable results, and the use of a randomized trial helped increase the internal validity of the results. Despite the possibility of cultural bias in the standardized tests used for participants from different cultural backgrounds, this study suggested the benefits of bilingual classrooms for academic success, corroborating with many other studies (Huzar, 1973; Campeau, 1975; Baker et al., 2012).

However, some researchers pointed out that potential language gains from EMI programs may be compromised if teachers switch to L1 and employ accommodation strategies to make themselves understood, which suggests that code-switching in EMI classrooms may limit students’ exposure to English input and thus negatively influence their language development (Jiang et al., 2019). In addition, some teachers believe that the alternation of two languages in classrooms may have negative effects on students’ academic achievement (Dooly, 2007; Agirdag et al., 2014). However, little empirical research has investigated the adverse effects of using L1 in EMI classrooms on content learning using objective measures, such as scores on academic tests, indicating a lack of solid evidence for this idea.

## **2.5 Summary**

Based on the literature, there is a lack of rigorous empirical research on EMI practices conducted in Chinese educational contexts despite numerous theoretical discussions about the features of EMI programs (Zhu & Yu, 2010). It seems that the enthusiastic promotion of EMI in China has been motivated by some optimistically envisioned benefits for students’ content and language learning rather than being grounded in empirical research (Hu, 2009a). In

addition, among the existing empirical studies on students' actual learning outcomes in EMI programs, language proficiency has been primarily focused on with little content-oriented research, and most of the research was conducted based on assumptions that indicate monolingual instead of bilingual priority (Chen et al., 2020). As for the research on language use in EMI classrooms, the use of L1 has not been researched systematically, and current research predominantly investigates frequency (Wannagat, 2007; Macaro et al., 2020) and teachers' and students' perceptions of EMI (Airey, 2012; Kırkgöz, 2014) based on self-reported surveys. The outcome studies vary a lot from qualitative studies in research design (Hoare & Kong, 2008), and thus, there is still no agreement about the impacts of L1 use on content learning in EMI classrooms. In such light, more research on this topic that uses objective measures like content tests is needed to provide evidence for language use at the micro-level.

### **3. Methods**

In this chapter, the quantitative and qualitative methods used to answer the research questions for this study are presented. This chapter also describes the characteristics of participants, the procedure of the experiment, and the outcomes for discussion.

#### **3.1 Research Design**

This study aims to analyze the effectiveness of L1 use in the EMI classroom and investigate whether the use of L1 is necessary for students' academic success in EMI settings. The following two research questions will be addressed.

1. What are the differential effects on the acquisition of content knowledge of L1-mediated learning compared to English-only learning?
2. What are students' perceptions about the influence of the use of L1 in the intervention on disciplinary knowledge acquisition?

Based on the research questions, this study was designed to be an experimental study with mixed methods where both quantitative and qualitative data were analyzed. The quantitative data were collected by conducting a parallel-group randomized control trial. These data were used to investigate whether students who attended an L1-mediated EMI course could get higher scores in the post-test and the delayed post-test than those who attended an English-only EMI course (RQ1). The qualitative data collected by questionnaires was used to investigate students' feelings about the use of L1 in the EMI classroom for a better understanding of language use in EMI settings.

#### **3.2 Setting**

This study was conducted online via Microsoft Teams among Chinese students from Sun Yat-Sen University, one of the top ten universities in China. This university was chosen for two reasons. Firstly, EMI programs in a wide range of disciplines have been provided at this university for several years, such as economics and literature, making the students there

representative of the population and an ideal sample for this study as they have specific experience with EMI courses. Secondly, because I got my bachelor's degree from this university one year ago, identifying and recruiting participants for this study was facilitated based on my personal relationships with the teachers there.

### **3.3 Participants**

#### **3.3.1 Inclusion and Exclusion Criteria**

Eligibility criteria for participants in this study are as follows.

Firstly, Mandarin was the participants' first language. Students who have other native languages, such as Cantonese, were excluded to ensure that all participants have equivalent native proficiency in Mandarin.

Secondly, participants had to have taken the College English Test-6 (CET-6) within two years and obtained scores of over 550 or have taken the Test for English Majors Grade Four (TEM-4) within two years and obtained scores of over 70. The College English Test-6 is a national standardized test of English proficiency for Chinese university students, and all students have to pass this exam (scores over 425) to get their bachelor's degree, except English majors. The Test for English Majors Grade Four is also a national standardized English proficiency test for English majors in Chinese universities, and all English majors have to pass this exam (scores over 60) to get their bachelor's degree. Students who obtain scores of over 550 in CET-6 and English majors who obtain scores of over 70 in TEM-4 are regarded as excellent in English, which is approximately equivalent to proficiency levels B2 or C1 in the Common European Framework of Reference for Languages (CEFR). In this study, those students who took these tests more than two years ago and those who obtained scores of lower than 550 in the CET-6, or lower than 70 in the TEM-4 were excluded to ensure that participants had similar English proficiency for lecture comprehension in the experiment.

Thirdly, all participants had to have little knowledge about the course content that was delivered in the EMI classroom. Those students who had basic knowledge about Maslow's

Hierarchy of Needs were excluded to minimize the effects of prior knowledge on participants' scores on the post-test and the delayed post-test.

Under these criteria, participants were controlled to have a similar linguistic background, and the effects of confounding variables were minimized.

### **3.3.2 Recruitment**

Following gatekeeper consent, participants were recruited via their teachers based on a convenience sampling procedure. Students were approached via email (email addresses were collected and provided by their teachers). The advertisement and the information sheet, as well as the consent form, were sent to students via the researcher's official university email to tell them about the aim of this study, how the experiment would be conducted, what they would be asked to do, and what kind of data would be collected, to help them make an informed decision about taking part. If they decided to participate in this study, they were asked to sign the consent form and return it to the researcher via email, with a deadline of three days before the intervention.

Students who agreed to participate were then sent a sign-up questionnaire via email. The questionnaire (Appendix 8.1) was designed to collect the basic demographic information needed for sample selection and data collection. Items on the questionnaire were: name, gender, age, major, native language, English proficiency (results of CET-6 or TEM-4), previous experience with EMI programs, prior knowledge about Maslow's Hierarchy of Needs, and time slot available for the intervention. By completing this questionnaire, students declared their eligibility for participation and availability for the experiment sessions. All of the personal information collected by the sign-up questionnaire was stored on the University of Oxford Nexus365 OneDrive for Business file storage service, which is approved by the university for all research data storage. These data were password-protected and kept separate from the rest of the research data.

After the sign-up deadline, which was three days before the first session of the experiment, those students who were eligible for this study (henceforth participants) were sent individual emails about their identification number and details of the online meetings on

Microsoft Teams, including the meeting link and the schedule for each session. On the days of the main sessions, including watching the course recordings and taking the post-test and the delayed post-test, email reminders were sent to all the participants in advance.

### 3.3.3 Sample

A total of 19 Chinese (3 males and 16 females) students in undergraduate study, aged between 20 and 24 years old, from Sun Yat-Sen University took part in this study. All participants were native speakers of Mandarin and had attended EMI courses before at the university. According to the data collected from the sign-up questionnaires, 6 out of 19 participants obtained scores of over 550 in the CET-6, and 13 out of 19 participants obtained scores of over 70 in the TEM-4 within two years, indicating a higher level of English proficiency. All participants have not formally acquired knowledge about Maslow’s Hierarchy of Needs, which was the course content delivered in the study.

*Table 1. Participant Demographics*

Measure	Items	Frequency	Percentage
<b>Gender</b>	male	3	15.8%
	female	16	84.2%
<b>Age</b>	20-22	7	36.84%
	23-24	12	63.16%
<b>Major</b>	English Majors	6	31.58%
	Non-English Majors	13	68.42%
<b>English Proficiency</b>	CET-6 500-600	2	10.53%
	>600	8	42.11%
	TEM-4 70-80	3	15.78%
	>80	6	31.58%

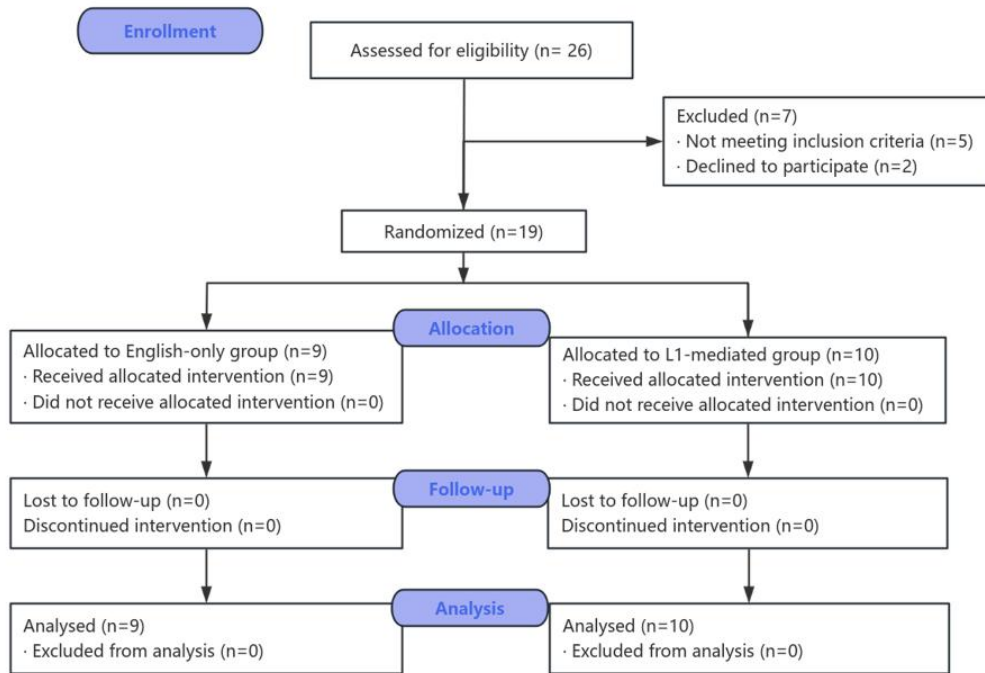
### **3.4 Experiment**

#### **3.4.1 Allocation**

Because the sample size is relatively small and all participants are high-level English learners, stratification was not deemed necessary to protect against allocation bias. Therefore, simple randomization was used, and participants were directly allocated to two groups based on chance.

Each participant was assigned a unique number for identification. Their names were not used, in order to ensure that their individual information could not be accessed during the experiment, especially during the procedures of allocation and marking, to minimize the effects of bias that may negatively influence the reliability of results. Participants' identification numbers were put into the random sequence generator and allocated into two groups. During the randomization process, all the identification numbers were listed in the field at RANDOM.ORG. After clicking the button "randomize," these numbers were presented in random order. Then, the top 10 numbers were allocated to the English-only group, while the other 10 numbers were allocated to the L1-mediated group. The first group (n = 9) was assigned as the comparison group, which took part in the English-only condition of the experiment, while the second group (n = 10) was assigned as the experimental group, which engaged in the L1-mediated EMI condition. Group allocation was concealed from participants and the teacher who delivered the course in this experiment until the intervention was carried out. This allocation allowed the comparison between two groups that attended online classes in different linguistic conditions while maintaining approximately the same course content.

Figure 1. CONSORT Flow Diagram



### 3.4.2 Materials and Procedure

#### 3.4.2.1 Recording

The English-only EMI course and the L1-mediated EMI course were both recorded by a DPhil student in the Department of Education at the University of Oxford. The same microphone and computer were used for both recordings. The DPhil student obtained her bachelor's and master's degrees abroad and has rich experience with EMI courses. In addition, she had teaching experience in physics and psychology, indicating that she was qualified and perfectly fit for this study. The fact that the two courses were recorded by the same teacher minimized the effects caused by different teachers' different teaching styles and pedagogical strategies on participants' disciplinary knowledge acquisition.

Both of these two course recordings were around 15 minutes. The course contents were generally the same, but the medium of instruction differed. The English-only EMI course was delivered solely in English, and all the content in the PowerPoint was presented in English. In contrast, the L1-mediated EMI course was delivered in a mixed language of English and Chinese, and the content in the PowerPoint was mostly presented in English, with specific

terms translated into Chinese. In the L1-mediated course, the teacher explained some terms and elaborated on some arguments in Chinese, resulting in tiny differences in the course content from that in the English-only EMI course.

#### **3.4.2.2 The Post-test and the Delayed Post-test**

The post-test (Appendix 8.2) and the delayed post-test (Appendix 8.3) were designed to assess participants' mastery of the subject knowledge that was delivered in the EMI courses. Both the post-test and the delayed post-test were presented in English, and participants were asked to write all the answers in English. To provide two comprehensive tests for assessment, these two tests were designed to cover as much of the knowledge points delivered in the courses as possible. There was no pre-test in this study because all participants reported that they had no prior knowledge about Maslow's Hierarchy of Needs in the recruitment stage, minimizing the potential influence of this variable.

The post-test and the delayed post-test contained two types of questions: multiple-choice questions and True or False questions. All these questions were objective, with an unchanging correct response for accurate marking and quantitative results. The delayed post-test assessed the same content as the post-test, but the questions were presented in a different way. The questions of the delayed post-test were designed in a different form to eliminate the practice effects. For example, some of the multiple-choice questions in the post-test were transformed into True or False questions in the delayed post-test, but they still assessed the same course content.

#### **3.4.3 Procedure**

All participants, both the comparison group and the intervention group, were asked to take part in the intervention session and complete the same tasks simultaneously. The procedure for the experiment is described below.

The first session took place online via Microsoft Teams after the researcher obtained participants' consent. The researcher played the course recordings for two groups respectively

in the online meeting room. The comparison group watched the 15-minute course video of the English-only condition, while the intervention group watched the 15-minute pre-recorded course video of the L1-mediated condition. During this process, participants were asked to turn on the camera, and the researcher was in the online meeting room to ensure that every student was concentrating on the course recordings with their eyes fixed on the screen.

Following the 15-minute intervention, participants had a 5-minute break without leaving the online meeting room to avoid fatigue. After that, participants of both groups were asked to click the link provided in the chatting box on Microsoft Teams and complete the post-test within 15 minutes. Before leaving the online room, participants were asked to submit the completed post-test to the researcher via the link for marking. After one week, participants were asked to enter another online meeting room to take the delayed post-test, a different version of the post-test. The testing procedure was totally the same as that for the post-test, and participants were asked to submit it within 15 minutes.

During the testing process, participants were not allowed to use any technological tool to search for information online, and they had to keep the camera on all the time with their faces right in the middle of the screen. To prevent participants from cheating in the tests, before taking these two tests, participants were told that all the information that they were asked to provide in the tests, except the answers, was their identification number. In this way, all the answers were marked anonymously, and the scores did not make any difference to or have any implication for their future study.

Based on the information above, it can be seen that other than the medium of instruction in the EMI classroom, the other variables in this study were the same: Both courses were recorded by the same teacher, who used the same PowerPoint (except specific translated terms) in class, and all participants in the two groups took the same tests with the same marking criteria. In addition, the participants in the study shared the same demographic characteristics. The control of other variables except the medium of instruction made the comparison group and the intervention group comparable to answer the research questions.

### **3.5 Questionnaire**

After taking the delayed post-test, a link for the questionnaires was sent to participants of both groups via email, and they were asked to complete the questionnaire in three days and submit it to the researcher via the link. There are two versions of the questionnaire. The questionnaire for the L1-intermediated group consists of a few more questions concerning the use of L1 in the experiment, with the questions in the questionnaire for the English-only group also included.

The questionnaires (Appendices 8.4, 8.5, 8.6) used in this study were designed to answer the second research question and contained two types of questions: Likert-scale questions and open-ended questions. Likert-scale items were designed for self-reported lecture comprehension, and open questions were also designed for a wider range of answers to avoid the limitation to participants' thoughts caused by leading questions. This questionnaire aimed to investigate (a) participants' feelings about the use of L1 in the intervention, (b) their perspectives about the effectiveness of using L1 on disciplinary knowledge acquisition, and (c) the reasons for their thoughts in order to better understand language use in EMI classrooms from different angles.

### **3.6 Data Analysis Strategy**

#### **3.6.1 Outcome Assessment**

The researcher marked the answers in the post-test and the delayed post-test by deciding whether the answers were consistent with the course content. The marking process was blind to group allocation to work against any marking bias. There were 10 multiple-choice questions and 10 True or False questions respectively in the two tests, each worth five points. The objective questions brought great simplicity to the marking process and yielded tangible results.

### 3.6.2 Statistical Methods

In this experiment, the independent variables were nominal variables, and the dependent variables were ratio variables. To answer the first research question, this study compared the mean difference between the two groups' scores on the post-test and the delayed post-test. In addition, to investigate the effects of L1 use in the EMI classroom in-depth, the difference in the scores on the two tests within each group was also analyzed to examine the retention of knowledge. Therefore, both descriptive analysis and inferential analysis were conducted for the quantitative data in this study. Because the data all fit the normal distribution, the test results were analyzed using an independent t-test between the two groups and a paired t-test within the same group.

As for the data collected from the questionnaire, response options for the Likert-scale questions were first assigned numerical values and then input into SPSS for descriptive analysis. In terms of the open-ended questions, the responses were coded inductively. After reading through the raw data, relevant segments of the texts were identified and assigned codes. Then, similar codes were grouped into broader themes. Finally, with a clear definition of each theme, themes were integrated, and quotes from the data were used to illustrate the theme for the analysis and discussion of the qualitative data.

*Table 2. Data Analysis Methods*

Research Question	Data Collection	Data Analysis
Does the use of L1 in the EMI classroom facilitate the acquisition of subject knowledge?	Post-test Delayed Post-test	Descriptive Analysis  Independent T-tests  Paired T-tests
What are students' perceptions about the influence of the use of L1 in the intervention on disciplinary knowledge acquisition?	Questionnaire	Qualitative Analysis

### **3.7 Blinding**

As the marker, the researcher never communicated with the participants, eliminating certain biases caused by personal links to the maximum extent. In addition, the marking process was carried out blind to group allocation. The researcher finished the marking before matching the participants' identification numbers to the allocation group. It means that the researcher did not know which group (the comparison group or the intervention group) the participants belonged to during the marking process, minimizing the bias that may influence the reliability of the results.

### **3.8 Ethical Considerations**

Prior to data collection, this study was reviewed by and received ethics approval from the Central University Ethics Committee at the University of Oxford. This study also followed the Ethical Guidance for Educational Research issued by the British Educational Research Association. All participants were informed about what they would be asked to do in the study before they made the decision to take part by reading the information sheet. In addition, participants could withdraw from the study at any time before the data were anonymized.

As for data protection, all the data collected in the study would be treated safely and anonymously, which Oxford University staff involved with data control, the researcher, and her supervisor at the University of Oxford would have access to. The data would be pseudonymized by replacing personal identifiers with IDs, and the data containing the personal identifiers would be stored separately and deleted immediately after the study was finished. The rest of the data will be deleted after three years from the completion of the researcher's MSc program.

Although the study involved intervention, the intervention activities were similar to those routines in EMI classrooms at the university. Therefore, it would not bring any risks or harm to all the participants. In addition, the researcher made efforts to reduce participants' stress caused by taking the post-test and the delayed post-test by telling them that the test scores would make no difference to their future study.

## 4. Results

This chapter presents the results of the experiment and is structured based on the sequence of the research questions. Initially, it reports on whether the intervention significantly influenced participants' acquisition of content knowledge by comparing the scores of the comparison group and the experimental group on the post-test and the delayed post-test, as well as the scores on the two tests within each group. These two tests were designed to assess students' mastery of the content knowledge delivered in the intervention. Subsequently, it reports on the findings of the questionnaire to examine the perceptions of participants in the experimental group about L1 use in the EMI classroom.

### **4.1 RQ 1: What are the differential effects on the acquisition of content knowledge of L1-mediated learning compared to English-only learning (between two groups)?**

#### **4.1.1 Descriptive Analysis**

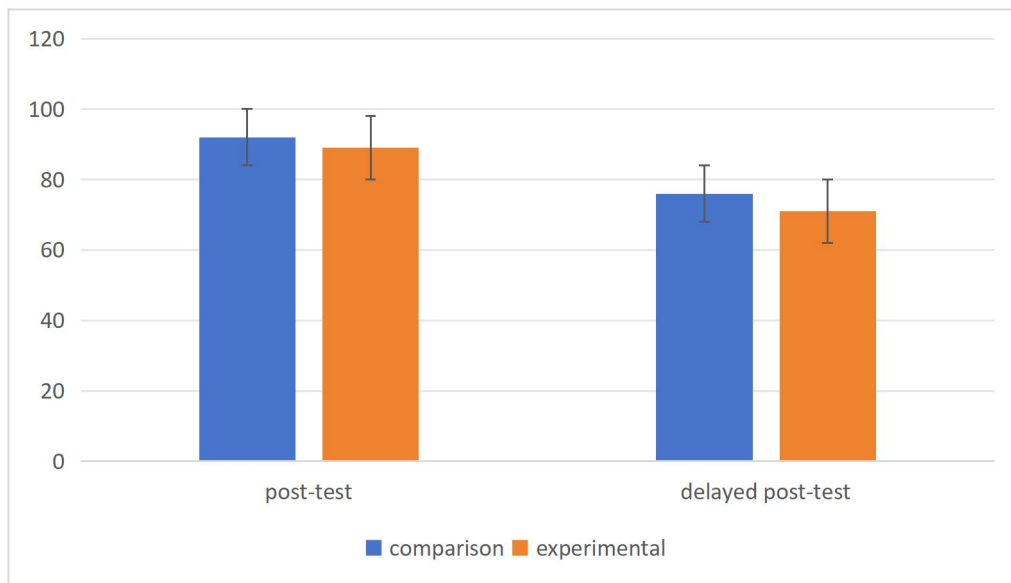
The first research question was designed to investigate the difference in participants' content learning outcomes between the English-only group and the L1-mediated group. The findings are based on the scores on the post-test and the delayed post-test, which were designed to assess their content knowledge. The test scores were marked by counting the number of correct answers, ranging from 0 to 100.

Table 3 presents the descriptive statistics for the test results for both groups. These data are also visually illustrated in Figure 2. At the post-test, the mean score for the English-only group was 92.22 (SD = 4.41) and 88.50 (SD = 6.26) for the L1-mediated group. At the delayed post-test, the mean score for the English-only group was 75.56 (SD = 12.86) and 71.00 (SD = 17.13) for the L1-mediated group.

Table 3. Descriptive Statistics for the Post-test and the Delayed Post-test

Condition	Time	N	Range	Minimum	Max	Mean	Std. Deviation
English-only (Comparison)	Post-test	9	15	85	100	92.22	4.41
	Delayed Post-test	9	35	60	95	75.56	12.86
L1-mediated (Experimental)	Post-test	10	20	80	100	88.50	6.26
	Delayed Post-test	10	50	50	100	71.00	17.13

Figure 2. Descriptive Statistics for the Post-test and the Delayed Post-test



The results presented above (including the overlapping error bars) suggested that the intervention in the experiment, which refers to using L1 for instruction in the EMI classroom, appeared to be no more or less effective than the instruction for the English-only group. Before the data were analyzed via an independent samples t-test using SPSS (version 26), they were first tested for normality. See Appendix 8.8.1 for the entire table.

According to the statistics, the means of the four test scores (post-test and delayed post-test for the English-only group and the L1-mediated group) were not significantly skewed or kurtotic. Further tests of normality were conducted to ensure that this assumption was met for further statistical analysis.

The Kolmogorov-Smirnov test results indicated that three of the four mean scores followed a normal distribution, with the mean score of the experimental group in the post-test showing a slight skew:  $D(10) = 0.312$ ,  $p = 0.007$ .

The Shapiro-Wilk test was conducted to determine the extent of normality. According to this test, all four mean scores were normally distributed:  $D(10) = 0.871, p = 0.301$ .

Therefore, based on all these results for testing normality, the data in this experiment can be seen to fit a normal distribution and meet one of the assumptions for carrying out an independent t-test and a paired t-test.

*Table 4. Tests of Normality*

Group		Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
English-only (Comparison)	Post-test	.248	9	.116	.913	9	.338
	Delayed post-test	.128	9	.200*	.940	9	.577
L1-mediated (Experimental)	Post-test	.312	10	.007	.871	10	.102
	Delayed post-test	.223	10	.171	.913	10	.301

\*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

#### 4.1.2 Inferential Analysis

To answer the first research question, the mean difference of participants' scores on the post-test and the delayed post-test was compared to determine whether they were significantly different, thus examining the effects of the intervention. As a result, an analysis of an independent t-test was carried out.

Before conducting an independent t-test, three assumptions were checked to ensure the validity and reliability of the test results. First of all, these scores were collected from two independent groups that do not influence each other. In addition, from the data presented above, all four test scores were approximately normally distributed. The final assumption concerns the homogeneity of variance. As shown in Table 5, according to Levene's test results, the p-value was 0.206 for the post-test and 0.472 for the delayed post-test. These two p-values were greater than 0.05, which meant that the variances of the two groups were approximately equal, meeting the assumption for conducting a t-test. As all three assumptions were met, an independent t-test was carried out, and the results are shown in Tables 5 and 6 below.

Table 5. Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Post-test	English-only	9	92.2222	4.40959	1.46986
	L1-mediated	10	88.5000	6.25833	1.97906
Delayed post-test	English-only	9	75.5556	12.85604	4.28535
	L1-mediated	10	71.0000	17.12698	5.41603

Table 6. Independent Samples Test (Test Scores)

		Levene's Test		t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	CI
posttest	Equal variances assumed	1.728	.206	1.482	17	.157	3.72222	2.51181	[-1.58, 0.02]
	Equal variances not assumed			1.510	16.142	.150	3.72222	2.46519	[-1.50, 8.94]
Delayed posttest	Equal variances assumed	.541	.472	.649	17	.525	4.55556	7.01456	[-10.24, 19.35]
	Equal variances not assumed			.660	16.515	.519	4.55556	6.90634	[-10.05, 19.16]

For the post-test, the test results showed that the mean score for the English-only group ( $M = 92.22$ ) was slightly higher than that of the L1-mediated ( $M = 88.50$ ) group. The t-test for equality of means resulted in a t-value of 1.482 with a p-value of 0.157. For the delayed post-test, the test results showed that the mean score for the English-only group ( $M = 75.56$ ) was again slightly higher than that of the L1-mediated ( $M = 71.00$ ) group. The t-test for equality of means resulted in a t-value of 0.649 with a p-value of 0.525. The p-values were greater than the significance level of 0.05. Therefore, there was no statistically significant difference between the two groups' scores on both the post-test and the delayed post-test. These results suggested that the incorporation of L1 in the EMI classroom may not have a notable impact on content learning in this context.

## 4.2 RQ 1: Does the use of L1 in the EMI classroom facilitate the acquisition of subject knowledge (within one group)?

### 4.2.1 Inferential Analysis of Paired T-tests

To further evaluate whether the use of L1 in the EMI classroom is effective for acquiring disciplinary knowledge, another three t-tests for data analysis were carried out to examine the difference in the retention of content knowledge between the English-only group and the L1-mediated group. The findings are based on the differences in their scores on the post-test and the delayed post-test, as shown in Table 7.

*Table 7. Descriptive Statistics for the Differences in the Test Scores*

Condition	N	Range	Minimum	Max	Mean	Std. Deviation
English-only	9	35	-5	30	16.67	11.46
L1-mediated	10	50	0	40	17.50	15.32

In contrast to prior analysis, this argument was tested first by comparing scores on the post-test and the delayed post-test within each group. Because the data were approximately normally distributed and consisted of paired observations independent of the other pair, the assumptions of conducting a paired t-test were met. See Appendix 8.8.2 for the entire table.

*Table 8. Paired Samples Test (English-only)*

		Mean	Std. Deviation	Std. Error Mean	CI	t	df	Sig. (2-tailed)
Pair 1	Post-test - Delayed post-test	16.66667	11.45644	3.81881	[7.86, 25.47]	4.364	8	.002

*Table 9. Paired Samples Test (L1-mediated)*

		Mean	Std. Deviation	Std. Error Mean	CI	t	df	Sig. (2-tailed)
Pair 2	Post-test - Delayed post-test	17.50000	15.32065	4.84481	[6.54, 28.46]	3.162	9	.006

Table 8 presents that, for the comparison (English-only) group, the mean scores on the post-test and the delayed post-test decreased by an average of 16.67 points (SD = 11.46, p =

0.002). Table 9 presents that, for the experimental (L1-mediated) group, the mean scores on the two tests decreased by an average of 17.50 points (SD = 15.32,  $p = 0.006$ ). The  $p$ -values of both data were well below 0.05, with these differences being statistically significant. The results indicated that both groups showed significant differences in the scores on the two tests, which could imply a decline in the retention of content knowledge over time. In the following section, such differences between the two groups were further analyzed to explore the effectiveness of using L1 in EMI settings.

#### 4.2.2 Inferential Analysis of an Independent T-test

As shown above, students' mastery of knowledge declined with time. Under this condition, further analysis was carried out to compare the magnitudes of the differences and examine if one group retained the content better than the other. Therefore, an independent t-test was used to compare the differences in the test scores of these two groups.

*Table 10. Independent Samples Test (Differences in Test Scores)*

		Levene's Test		t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	CI
Difference	Equal variances assumed	.913	.353	-.133	17	.896	-.83333	6.26681	[-14.06, 12.39]
	Equal variances not assumed			-.135	16.495	.894	-.83333	6.16892	[-13.88, 12.21]

As can be seen in Table 10, the assumptions for the independent t-test were met, with equal variances assumed based on Levene's test. The mean difference of -0.833 suggested that, on average, the difference in test scores between the two groups was relatively small and insignificant. The t-test for equality of means resulted in a t-value of -0.133 with a  $p$ -value of 0.896, indicating no statistically significant difference between the mean test score differences of the two groups. It implied that the use of L1 in the EMI classroom in this experiment did not lead to a significant difference in the retention of content knowledge (as

measured by the differences in the post-test and the delayed post-test) between the English-only group and the L1-mediated group.

#### 4.3 RQ 2: What are students’ perceptions about the influence of the use of L1 in the intervention on disciplinary knowledge acquisition (Likert-scale Questions)?

##### 4.3.1 Descriptive Analysis of Likert-scale Questions (both Groups)

After taking the post-test and the delayed post-test, participants of both groups were asked to complete a questionnaire, respectively, and the data collected were analyzed quantitatively.

In the first section of the questionnaire, the statements presented to participants of both groups required responses on a five-point Likert scale, with 1 indicating “strongly disagree,” 3 indicating “neutral,” and 5 indicating “strongly agree.” The first four questions in this section were the same for both the English-only group and the L1-mediated group. The four statements are:

1. I totally understood the lecture content.
2. The specialist terms in English negatively influenced my lecture comprehension.
3. The lecture’s speaking rate was too fast.
4. I needed more time to comprehend the lecture content that was delivered in English.

Descriptive statistics for the questionnaire data are presented in Tables 11 and 12.

*Table 11. Descriptive Statistics for Questions 1-4 (English-only)*

	N	Range	Minimum	Maximum	Mean	Std. Error	Std. Deviation	Variance	Skewness	Kurtosis		
Q1	9	1	4	5	4.22	.147	.441	.194	1.620	.717	.735	1.400
Q2	9	4	1	5	2.67	.408	1.225	1.500	.816	.717	.349	1.400
Q3	9	2	1	3	1.78	.222	.667	.444	.254	.717	-.040	1.400
Q4	9	3	2	5	3.22	.324	.972	.944	.502	.717	-.009	1.400

Table 12. Descriptive Statistics for Questions 1-4 (L1-mediated)

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Std. Deviation	Variance	Skewness	Kurtosis		
Q1	10	2	3	5	4.20	.200	.632	.400	-.132	.687	.179	1.334
Q2	10	3	1	4	2.20	.291	.919	.844	.601	.687	.396	1.334
Q3	10	2	1	3	1.80	.249	.789	.622	.407	.687	-1.074	1.334
Q4	10	3	1	4	2.90	.379	1.197	1.433	-.738	.687	-.878	1.334

For Q1, the high mean values (4.22 for the English-only group and 4.20 for the L1-mediated group) indicated that participants generally rated the question positively. The skewness value (1.62) and kurtosis value (1.40) for the English-only group suggested that responses in this group were more positively skewed and had a more peaked distribution. Therefore, participants in both groups seemed to have a similar level of lecture comprehension, with the English-only group gaining a little better understanding. For Q2, lower mean values indicated fewer positive responses. The English-only group had a higher mean value (2.67), suggesting that they struggled more with specialist terms in English than the L1-mediated group (M = 2.20). For Q3, the low mean values (1.78 for the English-only group and 1.80 for the L1-mediated group) indicated that the lecture's speaking rate was acceptable and did not lead to any difference in the lecture comprehension of participants in both groups. For Q4, compared to the English-only group (M = 3.22), the L1-mediated group (M = 2.90) reported that less time was needed to understand the course content delivered in English when certain content was delivered in Mandarin.

#### 4.3.2 Descriptive Analysis of Likert-scale Questions (L1-mediated Group)

In addition to the four questions designed for both groups, there were four other five-point Likert-scale questions designed only for the L1-mediated group to explore further the effectiveness of using L1 in the EMI classroom. The four statements are:

5. I felt more engaged and interested in the lecture when Mandarin was used.
6. I was more impressed with the lecture content that was delivered in Mandarin.
7. The lecture content that was delivered in Mandarin reminded me of my prior knowledge or experience that is related to Maslow's theory.

8. I could retrieve the information that was delivered in Mandarin from memory more quickly than other information that was delivered in English during the tests.

Descriptive statistics for the questionnaire data are presented in Table 13.

*Table 13. Descriptive Statistics for Questions 5-8 (L1-mediated)*

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness	Kurtosis			
Q5	10	3	2	5	3.60	.340	1.075	1.156	-.322	.687	-.882	1.334
Q6	10	3	2	5	3.60	.267	.843	.711	-.389	.687	.370	1.334
Q7	10	3	2	5	4.10	.277	.876	.767	-1.465	.687	3.613	1.334
Q8	10	3	2	5	3.60	.340	1.075	1.156	-.322	.687	-.882	1.334

The mean values for these four questions were all between 3.6 and 4.1, indicating a high level of agreement. Q7 received the highest mean score (4.10), suggesting that participants in the L1-mediated group strongly agreed that the use of L1 could remind them of prior experience. Q6 had the most minor variability (SD = 0.843), showing consistent responses regarding being impressed with L1-delivered content. The skewness values for these four questions were all negative, with that for Q7 (-1.465) being significantly negative. These values showed a tendency towards higher scores, indicating participants' positive attitudes towards the use of L1 for content learning in the intervention. Based on these data, participants in the L1-mediated group were more engaged in the EMI classroom and could perform better in the tests.

#### **4.4 RQ 2: What are students' perceptions about the influence of the use of L1 in the intervention on disciplinary knowledge acquisition (Open Questions)?**

In the second section of the questionnaire, three open questions were designed for the L1-mediated group, and the data collected were qualitatively analyzed, as explained in Section 3.6.2 in the Methodology chapter.

All three questions were designed to investigate the opinions of participants in the L1-mediated group about the effectiveness of using Mandarin in the intervention. Based on

their answers, several codes were identified, and these codes were categorized into two types concerning the effects of the use of Mandarin: positive codes and negative codes.

#### **4.4.1 Positive Effects**

##### **4.4.1.1 Better Comprehension**

Nearly all respondents mentioned the benefit of using Mandarin in facilitating lecture comprehension, leading to higher learning efficiency. This positive effect can be explained in several aspects. Some respondents highlighted the importance of using Mandarin to clarify complicated terms. As Participant 3 said,

*‘Mandarin could reduce my cognitive burden when it comes to technical terms.’*

Participant 12 even thought it was necessary,

*‘to use Mandarin to clarify complex terms for non-English-speaking students.’*

In addition to explaining terms, using Mandarin can facilitate lecture comprehension as a complement to English. As Participant 10 said,

*‘It is complementary to my understanding of the lecture and can help me know the exact meaning of unfamiliar words.’*

Additionally, two students mentioned the benefit of using Mandarin to summarize knowledge for better understanding. As Participant 4 said,

*‘I think it is effective when Mandarin is used to summarize the content after the content is delivered in English.’*

##### **4.4.1.2 Deeper Impression**

Another positive effect of using Mandarin was often mentioned as impressing students deeply to memorize the content knowledge better. As Participant 17 said,

*‘Using Mandarin could leave me with a deeper impression and help me better memorize the words and content delivered in class.’*

The deeper impression left by Mandarin is closely related to double understanding in the EMI classroom, which helps students better memorize the knowledge. As Participant 13 said,

*‘The use of Mandarin helps me rethink the knowledge learned in English again and understand the knowledge in two languages.’*

In addition, three students mentioned that using Mandarin in class impressed them a lot because of familiarity, as Mandarin is their native language. As Participant 15 said,

*‘When the lecturer was speaking in Mandarin, the content was presented in a more vivid and familiar way, which helped me better memorize it.’*

#### **4.4.1.3 Concentration**

Some students mentioned that they could concentrate better on the course when Mandarin was used to deliver the content. As Participant 14 said,

*‘When I am absent-minded, Mandarin can help me regain my concentration.’*

Similarly, Participant 20 also mentioned that,

*‘Mandarin can help me pay attention to the lecture when my mind escaped.’*

#### **4.4.1.4 Knowledge Retrieval**

Knowledge retrieval was also often cited as a benefit of using Mandarin, including relating to previous knowledge and retrieving learned knowledge. As Participant 19 said,

*‘The use of Mandarin could remind me of my previous knowledge related to the theory presented in the lecture.’*

As for the content knowledge learned in class, Participant 21 mentioned,

*‘Using Mandarin could facilitate and fasten my knowledge retrieval process.’*

#### **4.4.1.5 Others**

There is one positive effect that cannot be coded into any category above, so it is described here independently of others. As Participant 2 said,

*‘Using Mandarin can be very helpful when I need to read about some Chinese materials related to what is taught in the EMI programs.’*

This statement about the effectiveness of using Mandarin in EMI settings goes beyond the classroom environment; it is about facilitating self-study after EMI classes.

#### **4.4.2 Negative Effects**

##### **4.4.2.1 Distraction**

One adverse effect that was mostly cited concerning the use of Mandarin in the EMI classroom is that it may distract students' attention. As Participant 12 said,

*'But when I understand the English terms, sometimes using Mandarin is a bit distracting for me.'*

In addition, some students mentioned that when Mandarin is used in class, they may focus more on the Mandarin part with less attention to the English part. It may make them miss some parts of the lecture, leading to unsatisfactory academic learning outcomes. As Participant 13 said,

*'Due to the use of Mandarin, I will wait for the Mandarin part instead of listening carefully to the content delivered in English.'*

##### **4.4.2.2 Incoherence**

The emotional word "strange" was mentioned several times. Some students thought that using Mandarin in class made the lecture incoherent, and they might feel strange about this code-switching. As Participant 9 said,

*'Mandarin should not be used too much in class. Otherwise the class style will be too separate, making me feel strange and hindering the smooth learning process.'*

##### **4.4.2.3 Difficulty in Understanding**

Different from the opinions mentioned above, some students argued that using Mandarin may negatively influence lecture comprehension. Because some terms were originally

designed in English and have their logic, implementing these terms with explanations in English may make them less clear and difficult to understand. As Participant 15 said,

*‘In terms of learning key terms and concepts, using English will be more accurate and scientific, making it easier to understand.’*

#### **4.5 Summary of Results**

According to the quantitative findings, there is no statistically significant difference in the scores on the post-test and the delayed post-test between the English-only group and the L1-mediated group. The English-only group performed better in the two tests. As a result, the use of L1 in the intervention appeared to be no more or less effective for content learning. In addition, there is no significant difference in the test score differences between the two groups. The mastery of the content knowledge declined with time to a similar extent in both groups, which implied that the use of L1 did not make a difference to participants’ retention of the content knowledge.

According to the qualitative findings, the students showed both positive and negative attitudes toward the use of L1 (Mandarin) in the EMI classroom. They found that L1 use could facilitate lecture comprehension, help them focus on the course, memorize the content knowledge better, and retrieve related information more quickly. However, they also reported that L1 use could hinder their content learning as it may distract their attention and make the lesson incoherent and difficult to understand.

## **5. Discussion**

This chapter discusses the findings presented in the previous chapter to synthesize and contextualize them in relation to other existing studies within the fields of pedagogical translanguaging and bilingual education. As both research questions of this study focus on the effectiveness of L1 use in the EMI classroom, this chapter is structured based on the themes summarized from the data rather than the sequence of the research questions. In this way, RQ1 will be discussed together with RQ2. Based on the literature, this study will draw connections with existing studies on L1 use and content learning in EMI settings to situate this study within a broader literature.

### **5.1 Review of the Findings**

The data presented and analyzed above show the findings of this study concerning the use of L1 in EMI classrooms.

RQ1 examined the differential effects on the acquisition of content knowledge of L1-mediated learning compared to English-only learning. The intervention, which refers to the use of L1 in the EMI classroom, was found to be no more or less effective for students' mastery of content knowledge than the use of English only. There was no significant difference ( $p = 0.206$  for the post-test and  $0.472$  for the delayed post-test) in the test scores between the English-only group and the L1-mediated group, with the scores of the English-only group slightly higher in both tests. In addition, the differences in the two test scores within each group did not significantly differ ( $p = 0.896$ ), implying that the intervention did not affect students' retention of the content knowledge.

RQ2 explored students' perceptions about L1 use for content learning using a five-point Likert scale and self-reported answers. The data indicated that students had both positive and negative attitudes toward the use of L1 in this experiment from different perspectives, including lecture comprehension, classroom engagement. It seems that students' beliefs about L1 use in the EMI classroom were not supported by objective measures of academic success, which could have important implications for classroom practice.

## **5.2 Differential Effects on Disciplinary Knowledge Acquisition**

The findings of this study showed that students in the English-only group and those in the L1-mediated group performed equally well in both post-test and delayed post-test, suggesting that L1 use in the EMI classroom did not appear to facilitate or hinder students' academic attainments. Such findings corroborate previous studies on the effects of EMI programs (Hopp & Thoma, 2021; Hopp et al., 2021; Qureshi & Aljanadbah, 2022), which indicated that there is no statistically significant difference in academic performance between a translanguaging group and an English-only group. However, the findings are less well aligned with a larger number of previous studies, which argued that the use of L1 in EMI classrooms is effective for content learning (Plante, 1976; Abdulaal, 2020; Baker et al., 2012; Tang & Peng, 2020). As a result, the reasons for such a difference in these studies concerning the effectiveness of L1 use in EMI classrooms will be explored in this chapter.

### **5.2.1 Lecture Comprehension**

In terms of lecture comprehension, the qualitative data in this study showed that some participants had a positive attitude toward the effectiveness of using L1 in the EMI classroom, and they believed that L1 use could facilitate lecture comprehension in different ways. These positive results are consistent with other qualitative studies on teachers' and students' perspectives on L1 use in EMI settings (Schweer, 1999; Tang, 2002). It is possible to argue that L1 in EMI classrooms is conducive to content learning as it can deepen students' understanding by being used to clarify complex terms and concepts (Shimizu, 2006), provide local examples for elaboration (Moodley, 2007), and paraphrase the course content in two languages for a higher level of cognitive engagement (Williams, 2002).

In addition, the qualitative findings are also confirmed by studies that highlighted the role of L1 use in reminding students of previous experiences in relation to the course content for better lecture comprehension. Donovan and Bransford (2005, p. 4) stated, "New understandings are constructed on a foundation of existing understandings and experiences." In this way, students' prior beliefs or experiences could have a considerable impact on how they receive and interpret the information delivered in EMI classrooms (Cummins, 2007).

Consequently, students believed that the use of L1 in class could decode their prior experience encoded in L1 for optimal learning.

However, the quantitative data in this study showed that students in the L1-mediated group did not outperform those in the English-only group, and the use of L1 in the EMI classroom is not as effective as expected. There seems to be a mismatch between the findings drawn from the qualitative data and those from the quantitative data.

One assumption of the reason for such a difference is that the envisioned benefits of L1 use cannot be well embodied among high-level English learners because English as the medium of instruction tends not to cause significant challenges for them in lecture comprehension. As shown in the results of the first Likert scale in the questionnaire, most participants in both groups claimed that they totally understood the course content. This finding is in contrast to Hellekjaer's (2010) study, where students in EMI classrooms were reported to often encounter difficulty with unfamiliar words, which could have an adverse impact on their lecture comprehension. This discrepancy in findings might be attributed to students' English proficiency. As participants in the current study are all high-level English learners, understanding the course content delivered in English was less challenging for them, thus minimizing the potential positive effects of L1 use. This finding is consistent with Bialystok's (2011) study, which indicated that bilingual students with a high level of linguistic competence performed better both academically and cognitively than bilingual students with poor bilingual skills. Cummins (1979) pointed out that insufficient English skills are one of the major factors that may influence students' ability to understand the materials provided during instruction.

Another assumption of these counter-intuitive findings is that code-switching in EMI classrooms may make the lecture incoherent and thus increase students' cognitive burden, which is contrary to the claim of Williams (2002), who asserted that code-switching in class could incur a higher level of cognitive engagement. According to Cognitive Load Theory (Sweller, 1988), switching between two languages might increase students' cognitive load as learners have a limited capacity for information processing. As a result, this overburden may prevent students from allocating more mental resources to understanding the course content for the learning process, leading to detrimental effects on lecture comprehension. This finding

is consistent with Spelke and Tsivkin's (2001) study, which suggested that during the process of switching between the language of instruction and the language of retrieval, cognitive costs were incurred for the learning process, which refers to the increased mental work that results in a disadvantage in academic performance. It is possible to argue that the differences in the assumed relation between code-switching and cognitive engagement in EMI classrooms can be partly explained by students' English competence. If students' English proficiency is high enough or nearly native-like, code-switching between English and their L1 might not be a cognitive burden. However, little empirical research has been conducted on this issue. As a result, further studies that investigate the impact of English proficiency on cognitive load concerning code-switching in EMI classrooms should be designed to better understand the influencing factors for this assumption.

As discussed above, English proficiency is an important factor that influences the effects of L1 use in EMI classrooms. If the most proficient English learners attend EMI courses, L1 use may be irrelevant and less effective for lecture comprehension. If, however, students with lower English proficiency attend EMI courses, it might be that they are disadvantaging themselves due to cognitive burden, or that research might find that incorporating L1 is useful for them to grasp the course content. Therefore, in future research on the effectiveness of L1 use in EMI classrooms, students' English proficiency should be considered and further analyzed for more accurate results.

### **5.2.2 Classroom Engagement**

In terms of classroom engagement, the qualitative data in this study showed that some participants approved of the benefits of L1 use as they felt that their familiarity with L1 could help them concentrate on the course content. However, their positive beliefs about the effectiveness of L1 use were not confirmed by the quantitative data. According to the test scores, participants in the English-only group performed slightly better than those in the L1-mediated group, implying a higher level of classroom attention of participants in the English-only group. As a result, the reasons for such a difference will be discussed.

It is possible to argue that participants in the L1-mediated group might tend to ignore the English part and instead wait for the Chinese part to reduce their cognitive burden during academic learning, leading to unsatisfactory learning outcomes. Learners allocate their limited cognitive resources based on different perceived factors, such as familiarity and difficulty (Sweller, 1988). When faced with instruction in a second language, which requires more cognitive resources, students may naturally pay more attention to instruction in their L1 to reduce the cognitive load. This finding resonates with the findings of Gernsbacher and Kaschak (2003), who demonstrated that understanding and processing information in a familiar language demands less cognitive effort than in a second language. Therefore, students' tendency to depend heavily on L1 might result in a superficial understanding of the course content, leading to poor academic performance.

In addition, for the participants in this study who reported a strong understanding of the course content, it is plausible to assume that the Chinese part of the lecture served as a complement to the English part. However, given their proficiency in English, these students might have perceived some of the Chinese part, which was a literal translation of the English part, as redundant. When students have already grasped the content delivered in English, the subsequent literal Chinese translation could be viewed as unnecessary repetition. This redundancy can lead to disengagement and distraction due to the lack of new information being provided. Therefore, for these high-level English learners, the use of L1 in the EMI classroom sometimes cannot contribute to their content learning and might instead disrupt their attention and learning process. However, this assumption about the reason for disengagement in the L1-mediated EMI classroom is based on self-reported answers from the questionnaires in this study, and little existing research has investigated the impacts of L1 use on students' attention to the course content. As a result, more studies should be conducted to explore further whether L1 use could facilitate or hinder students' concentration in EMI classrooms.

As discussed above, the results of this study are less well aligned with many strong claims about the benefits of translanguaging in EMI classrooms in existing research (Abdulaal, 2020; Baker et al., 2012; Tang & Peng, 2020), suggesting that L1 use does not facilitate students' academic learning. In addition to the reasons mentioned above, the differences in

findings might be partly attributed to the poor quality of the methodology of these studies, many of which were poorly designed for making causal inferences, leading to questionable conclusions. In Abdulaal's (2020) study, the translanguaging group significantly outperformed the English-only group, which supported the use of L1 for students to employ useful resources for highly engaged subject learning. Similarly, Tang and Peng's (2019) study showed that the translanguaging group scored higher in all areas studied. However, despite the significant results, these studies did not provide details on how the translanguaging approach was used in the classroom. The use of L1 is an important factor in understanding the impacts of language use on subject learning. Therefore, the lack of clarity of such an intervention may limit the ability to draw conclusions. As a result, some studies that provided supporting evidence for translanguaging approaches in classrooms have been evaluated as low-quality, showing the need for experiments with high-rated trustworthiness.

### **5.3 Disciplinary Knowledge Retention**

In terms of disciplinary knowledge retention, it is intrinsically linked to knowledge acquisition, as learners have to first acquire the knowledge to be able to retain it over time. Research data in this study indicated that there was no significant difference in knowledge retention between students who were exclusively taught in English and those who received instruction mediated by their L1. This conclusion is drawn from the observation that both groups showed similar differences in scores on the post-test and the delayed post-test.

The findings suggest that L1 use is no more or less effective in aiding students' mastery of subject knowledge. This outcome can be attributed to various factors influencing lecture comprehension and classroom engagement. As a result, both groups demonstrated a similar level of knowledge acquisition during the instructional period. Consequently, this led to a parallel degree of knowledge retention, with both groups experiencing a similar decline in content mastery over the same period, indicating that the language of instruction—whether English-only or L1-mediated—did not significantly impact the long-term retention of disciplinary knowledge.

#### **5.4 The Role of L1 Use in EMI Classrooms**

The integration of pedagogical translanguaging in EMI classrooms presents a complex balance between its potential benefits and the challenges it poses to EMI teachers. As Hincks (2010) argues, the implementation of translanguaging strategies requires considerable time and effort from EMI lecturers, particularly those with limited English proficiency. The additional time required for preparation may strain teachers, who may already feel overburdened by the responsibilities of teaching in a non-native language. Although some studies suggested that the use of L1 in EMI contexts may facilitate lecture comprehension and classroom engagement, its efficacy for content acquisition is not always guaranteed. The inconsistent results imply that the effectiveness of L1 use is influenced by various factors, such as teachers' and students' English competence, and how it is incorporated into the teaching process. As a result, there is a trade-off between developing bilingual teaching approaches and their impacts on students' disciplinary knowledge acquisition. This contradiction highlights the necessity for a more comprehensive consideration of the role of L1 use in EMI classrooms.

As discussed above, L1 use cannot be guaranteed to facilitate or hinder disciplinary knowledge acquisition in EMI settings, and its effectiveness is situation-dependent. Consequently, it is possible to argue that a flexible approach to incorporating students' L1 may be more beneficial than strictly enforcing an English-only or translanguaging policy in EMI classrooms. For example, if students like L1 use, teachers may choose to incorporate it in the knowledge that it will not negatively affect their attainment. Alternatively, if students are all proficient English learners, teachers may choose not to use L1, as it seems ineffective for content learning. By tailoring L1 use to the specific needs of the classroom, teachers can strike a balance that supports both content learning and language acquisition, ultimately leading to better educational outcomes.

## **5.5 Summary**

In summary, the study reveals an apparent mismatch between students' generally positive attitudes and the actual effectiveness of L1 use in EMI classrooms, which has been implied in many existing studies. Drawing from the qualitative data, students always perceive that the use of L1 in the EMI classroom greatly facilitates their disciplinary knowledge acquisition, while the reality reflected in the quantitative data appeared to be the opposite. It suggests that relying solely on students' beliefs and perceptions might be misleading. While qualitative data captures individual opinions, which contributes to understanding the subjective aspects of L1 use in EMI settings, these insights may not always align with the measurable outcomes reflected in the quantitative data. This discrepancy highlights the importance of grounding instructional conclusions in robust and objective evidence rather than solely on subjective reports. Objective data provides a more reliable foundation for assessing the effectiveness of L1 use in EMI classrooms, leading to more accurate and effective educational practices.

## **5.6 Limitations**

This study has several limitations that need to be acknowledged. Firstly, the small sample size suggests that a type one mistake cannot be eliminated, which may negatively affect the statistical precision of the findings. Secondly, as this study focused on relatively high proficiency English learners, the findings of this study cannot be generalized to students with low or immediate English proficiency. Third, the experimental setting of watching pre-recorded course videos did not replicate an ecologically real classroom environment, potentially limiting the applicability of the results to actual classroom conditions. Thirdly, students' prior knowledge about Maslow's Hierarchy of Needs was self-assessed, introducing a significant degree of subjectivity that could skew the initial baseline measurements. Lastly, the duration of the intervention was short, only 15 minutes, which might be insufficient for participants to have adequate exposure to the instructional content for a difference to be significant, thereby limiting the assessment of long-term learning outcomes and retention.

## **5.7 Implications for Future Study**

Due to the limited sample size of this study, future research investigating the effectiveness of L1 use in EMI classrooms could replicate this study with a larger sample size to improve the confidence in the results and allow for more statistically robust conclusions. Additionally, to further enhance generalizability, it is essential to recruit more participants from different genders, ages, disciplines and educational backgrounds so that they can more accurately represent the diverse population of EMI students. In this way, more nuanced effects of L1 use in different EMI settings can be better captured and understood.

In addition, as discussed above, the implementation of EMI programs are always based on subjective reports, which may differ from the quantitative results. Consequently, there is a need for more quantitative studies that objectively measure the effectiveness of L1 use in EMI settings. By employing rigorous quantitative methods, such as controlled experiments and standardized assessments, future research can provide clearer evidence on how L1 use affects students' content learning. Additionally, the relation between the effectiveness of L1 use and students' English proficiency could be a potential area of investigation. As there seems to be a significant difference between high and low proficiency learners, future studies could differentiate participants based on their English competence during recruitment and data analysis to provide a more comprehensive understanding of the role L1 and tailor recommendations for L1 use in EMI classrooms.

## 6. Conclusion

This study aimed to examine whether the use of L1 in EMI classrooms could facilitate or hinder students' disciplinary knowledge acquisition. It is an experimental study using two comparable groups of university students with high English proficiency aged 20 to 24. The comparison group received 15-minute English-only instruction, while the experimental group received 15-minute instruction delivered in both English and Chinese (their L1). In addition, the present study also investigated students' attitudes toward L1 use to discover the reasons for quantitative results by distributing questionnaires to participants in the L1-mediated group.

The results found that L1 use in the EMI classroom has an insignificant impact on students' content learning, as tested by the post-test and the delayed post-test. The English-only group and the L1-mediated group performed equally well in both tests, and the retention of knowledge showed a similar level of decline. Additionally, the qualitative results suggested that interviewees showed both positive and negative attitudes towards the effectiveness of L1 use in the EMI classroom from the perspectives of lecture comprehension and classroom engagement. Participants reported L1 use as beneficial as it facilitated understanding and knowledge retrieval, but some also thought that L1 use in the EMI classroom might be a distraction.

As discussed before, few empirical studies have investigated the effectiveness of L1 use on students' content learning in EMI classrooms, especially in bilingual teaching environments (Chen et al., 2020). As a result, by examining the relationship between L1 use and students' academic success, this study contributes to the growing literature on language use in EMI contexts and provides suggestions for EMI classroom practices.

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## 8. Appendices

### 8.1 Demographic Survey Questions

#### 被试的基本信息收集

牛津大学对研究数据与参与者信息保护有严格要求，收集的所有数据仅用于该研究项目，被试信息将以匿名的方式处理。

.....

\* 姓名 Name

\* 性别 Gender

男 Male

女 Female

\* 年龄 Age

\* 专业 Major

\* 母语 Mother Tongue

\* 英语水平 English Proficiency

六级分数 College English Test-6

专四等级 TEM-4

\* 邮箱 E-mail Address

\* 是否参加过EMI课程（用英语教授除英语外的其他学科）？

Have you ever participated in EMI courses?

【The use of the English language to teach academic subjects (other than English itself)】

是 Yes

否 No

\* 方便参与线上研究的时间段:

下周六 (6.1) 晚上 20:00—20:40

下周六 (6.1) 晚上 21:00—21:40

下周六 (6.1) 晚上其他时间:

## 8.2 Post-test Questions

1. Who created the concept of Maslow's Hierarchy of Needs?

- A. Sigmund Freud
- B. Carl Jung
- C. Abraham Maslow
- D. B.F. Skinner

2. In which year was Maslow's paper, "A Theory of Human Motivation", published?

- A. 1923
- B. 1943
- C. 1963
- D. 1983

3. How many levels of needs are in Maslow's Hierarchy?

- A) Three
- B) Four
- C) Five
- D) Six

4. What is the highest level of Maslow's Hierarchy of Needs?

- A. Safety Needs
- B. Social Needs
- C. Self-Esteem Needs
- D. Self-Actualization Needs

5. Which needs must be satisfied first according to Maslow's hierarchy?

- A. Esteem Needs
- B. Safety Needs
- C. Physiological Needs
- D. Social Needs

**6. Which of the following is NOT a physiological need according to Maslow?**

- A) Food
- B) Water
- C) Safety
- D) Shelter

**7. Self-actualization refers to which of the following?**

- A) Safety and security
- B) Achieving one's full potential and personal growth
- C) Love and belonging
- D) Physical health

**8. What do deficiency needs refer to in Maslow's hierarchy?**

- A. Needs for growth and personal development
- B. Basic needs and psychological needs
- C. Needs for social connections
- D. Needs for self-actualization

**9. In the workplace, which of the following is an example of a safety need?**

- A. Job security
- B. Social connections
- C. High status
- D. Self-respect

**10. Critics of Maslow's theory argue that it does not account for what?**

- A) Environmental factors
- B) Cultural differences
- C) Economic status
- D) Educational background

### True/False Questions

1. Maslow's Hierarchy of Needs suggests that humans are motivated to fulfill needs in a random order.
2. Safety needs are at the base of Maslow's Hierarchy of Needs.
3. Maslow's theory was initially focused on the needs of employees in the workplace.
4. According to Maslow, social needs must be met before physiological needs.
5. According to Maslow, esteem needs must be met before safety needs.
6. Esteem needs can be divided into lower esteem (respect from others) and higher esteem (self-respect).
7. Maslow's hierarchy considers safety needs to include job security and health insurance.
8. Growth needs in Maslow's model are also known as Deficiency needs.
9. According to Maslow, achieving self-actualization is unique to each individual.
10. Maslow believed that self-actualization could be achieved even if lower-level needs are not fully satisfied.

## 8.3 Delayed Post-test Questions

**1. In which publication did Maslow first present his hierarchy of needs?**

- a) "Motivation and Personality"
- b) "A Theory of Human Motivation"
- c) "The Interpretation of Dreams"
- d) "Behaviorism"

**2. How did Maslow's theory primarily focus on employee needs?**

- a) By ensuring employees receive regular promotions
- b) By emphasizing the importance of fulfilling basic needs for motivation
- c) By focusing on financial incentives
- d) By creating a competitive work environment

**3. Which statement is true about self-actualization?**

- a) It can be achieved without meeting lower-level needs
- b) It is the first level of needs according to Maslow
- c) It involves reaching one's full potential
- d) It is not included in Maslow's hierarchy

**4. According to Maslow, which needs must be satisfied before esteem needs can be addressed?**

- a) Self-actualization needs
- b) Social needs
- c) Safety needs
- d) Physiological needs

**5. What drives individuals to move from one level of Maslow's hierarchy to the next?**

- a) External rewards
- b) Internal motivation
- c) Societal pressure
- d) Random chance

**6. Which of the following best describes "deficiency needs" in Maslow's hierarchy?**

- a) Needs that motivate people when they are unmet
- b) Needs related to personal growth and self-fulfillment
- c) Needs related to creativity and problem-solving
- d) Needs that are satisfied only through external rewards

**7. Which concept did Maslow use to describe needs related to personal growth and self-fulfillment?**

- a) Deficiency needs
- b) Growth needs
- c) Physiological needs
- d) Safety needs

**8. Maslow's concept of "being needs" refers to which of the following?**

- a) Basic survival needs
- b) Needs that drive personal growth
- c) Needs related to external rewards
- d) Needs that are never fully satisfied

**9. According to Maslow, what happens to the motivation to fulfill needs when deficiency needs are not met?**

- a) It decreases
- b) It remains unchanged
- c) It increases
- d) It disappears

**10. In Maslow's view, which of the following is essential for reaching self-actualization?**

- a) Meeting all lower-level needs
- b) Achieving financial success
- c) Gaining social approval
- d) Maintaining physical health

### **True/False Questions**

- 1. According to Maslow, financial security is part of physiological needs.**
- 2. Maslow's hierarchy suggests that needs change over time.**
- 3. Maslow believed that people could skip levels in the hierarchy to achieve self-actualization.**
- 4. Deficiency needs refer to the needs that drive personal growth.**
- 5. The need for love and belonging is part of the deficiency needs in Maslow's hierarchy.**
- 6. Esteem needs can be satisfied by achieving recognition and respect from others.**
- 7. Higher esteem refers to self-respect in Maslow's hierarchy.**

8. Maslow's theory suggests that motivation can remain static over time.

9. Van Gogh's life challenges the idea that all needs must be met sequentially.

10. Maslow's model can account for cultural differences in needs prioritization.

## 8.4 Likert-scale Questions for Both Groups

### EMI研究—调查问卷

所有的问题都基于上周观看的15分钟录播课程，请大家用英文认真填写此问卷，谢谢！

EMI (English as the Medium of Instruction) is defined as "the use of the English language to teach academic subjects (other than English itself) in countries or jurisdictions: where the first language of the majority of the population is not English (Macaro, 2018)."

\* 1. 您的被试序号 Your Identification Number

\* 2. My identification number is between 1 and 11.

Yes

No

\* 3. I totally understood the lecture content.

Strongly Disagree

Strongly agree

1	2	3	4	5
---	---	---	---	---

\* 4. The specialist terms in English negatively influenced my lecture comprehension.

Strongly Disagree

Strongly agree

1	2	3	4	5
---	---	---	---	---

\* 5. The lecture's speaking rate was too fast.

Strongly Disagree					Strongly agree
1	2	3	4	5	

\* 6. I needed more time to comprehend the lecture content that was delivered in English.

Strongly Disagree					Strongly agree
1	2	3	4	5	

## 8.5 Likert-scale Questions for L1-mediated Group

\* 9. I felt more engaged and interested in the lecture when Mandarin was used.

Strongly Disagree					Strongly agree
1	2	3	4	5	

\* 10. I was more impressed with the lecture content that was delivered in Mandarin.

Strongly Disagree					Strongly agree
1	2	3	4	5	

\* 11. The lecture content that was delivered in Mandarin could remind me of my previous knowledge or experience that is related to Maslow's theory.

Strongly Disagree					Strongly agree
1	2	3	4	5	

\* 12. I could retrieve the information that was delivered in Mandarin from memory more quickly than other information that was delivered in English during the tests.

Strongly Disagree					Strongly agree
1	2	3	4	5	

## 8.6 Open Questions for L1-mediated Group

\* 16. What are your feelings about using Mandarin in this lecture?

Please answer this question in English.

- \* 17. Do you think it is effective to use Mandarin in this lecture or not? If yes, how did the use of Mandarin help you in this lecture? If not, why?

Please answer this question in English.

- \* 18. Are you satisfied with the use of Mandarin in this lecture or not? Why?

Please answer this question in English.

## 8.7 CUREC Documentation

### 8.7.1 CUREC Approval

**SOCIAL SCIENCES & HUMANITIES  
INTERDIVISIONAL RESEARCH ETHICS COMMITTEE  
DEPARTMENTAL RESEARCH ETHICS COMMITTEE**

Department of Education  
15 Norham Gardens, Oxford OX2 6PY  
[student.curec@education.ox.ac.uk](mailto:student.curec@education.ox.ac.uk); [staff.curec@education.ox.ac.uk](mailto:staff.curec@education.ox.ac.uk)



████████████████████  
Department of Education, Social Sciences Division  
University of Oxford

4 March 2024

Dear ██████████

#### **Research ethics approval**

**Research title:** The Effectiveness of the Use of L1 in EMI Courses on Disciplinary Knowledge Acquisition in Higher Education in China

**Research ethics reference:** EDUC\_C1A\_24\_095

The above application has been considered on behalf of the Education Departmental Research Ethics Committee (DREC) in accordance with the University's procedures for ethical approval of all research involving human participants.

I am pleased to confirm that, on the basis of the information provided to the DREC, ethics approval has now been granted for this study.

Please note the following:

**Personal data:** It is the responsibility of the PI to ensure that all personal data collected during the project is managed in accordance with the University's [guidance and legal requirements](#).

**In-person activities:** Any data collection involving in-person interactions with participants must have an up-to-date fieldwork risk assessment in place; further guidance is available from the Safety Office's [website](#).

**Amendments:** Please notify the committee if you intend to make any amendments to the information in your ethics application as submitted at date of this approval, as all changes must receive ethical approval prior to implementation. The amendment form is available on the [SSH IDREC webpage](#).

We welcome feedback on your experience of the ethical review process and suggestions for improvement. Please email any comments to [staff.curec@education.ox.ac.uk](mailto:staff.curec@education.ox.ac.uk) / [student.curec@education.ox.ac.uk](mailto:student.curec@education.ox.ac.uk) or [ethics@socsci.ox.ac.uk](mailto:ethics@socsci.ox.ac.uk).

Yours sincerely



James Carroll

DREC member

cc: Hamish Chalmers, [hamish.chalmers@education.ox.ac.uk](mailto:hamish.chalmers@education.ox.ac.uk)

## 8.7.2 Recruitment Material

DEPARTMENT OF EDUCATION  
15 Norham Gardens, Oxford, OX2 6PY



The Effectiveness of the Use of L1 in EMI Courses on Disciplinary Knowledge Acquisition in Higher Education in China

Ethics Approval Reference: EDUC\_C1A\_24\_095

### VOLUNTEERS NEEDED

EMI (English as the Medium of Instruction) has been introduced to mounting Chinese universities because of its dual commitments to both disciplinary knowledge acquisition and English language development. However, despite the challenges facing both teachers and students, many universities still strictly prohibit the use of L1 in EMI courses.

As a result, this study aims to analyze the effectiveness of using L1 in the EMI classroom on disciplinary knowledge acquisition and investigate whether the use of L1 is necessary for students' academic success in EMI settings, providing pedagogical suggestions for improving the efficiency of EMI programs.

We are looking for university volunteers, aged between 20 and 24 years old, to participate in this study about language use in EMI courses. Mandarin should be volunteers' first language, and they should get scores of over 550 in the College English Test-6 or scores of over 70 in the Test for English Majors Grade Four. You are invited to participate in an online study for four sessions. Each session would take about 20 minutes of your time. You would be asked to watch a 15-minute pre-recorded course video, complete a post-test and a delayed post-test, and complete a questionnaire.

If you are interested and would like more information, please contact [redacted] at the Department of Education, 15 Norham Gardens, Oxford, at [redacted]. There is no obligation to take part.

Thank you!

## 8.7.3 Information Sheet for Participants

### DEPARTMENT CONTACT DETAILS

Hamish Chalmers  
[hamish.chalmers@education.ox.ac.uk](mailto:hamish.chalmers@education.ox.ac.uk)

Oxford University telephone number: +44 (0) 1865 274024  
Oxford University email address: [REDACTED]



### The Effectiveness of the Use of L1 in EMI Courses on Disciplinary Knowledge Acquisition in Higher Education in China

#### PARTICIPANT INFORMATION SHEET

Central University Research Ethics Committee Approval Reference: EDUC\_C1A\_24\_095

#### 1. Introductory paragraph

You are being invited to take part in a research project. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether you wish to take part.

#### 2. Why is this research being conducted?

EMI (English as the Medium of Instruction) has been introduced to mounting Chinese universities because of its dual commitments to both disciplinary knowledge acquisition and English language development. However, it has been found that students with a low level of English ability struggle with understanding the course content, and teachers have difficulty in delivering course content only in English in the EMI classroom. Nonetheless, many universities still strictly prohibit the use of L1 in EMI courses.

As a result, this study aims to analyze the effectiveness of using L1 in the EMI classroom on disciplinary knowledge acquisition and investigate whether the use of L1 is necessary for students' academic success in EMI settings. This study will provide insights about the language use in EMI courses and have pedagogical implications for improving the efficiency of EMI programs.

#### 3. Why have I been invited to take part?

If 1) you are a university student aged between 20 and 24 years old; 2) Mandarin is your first language; and 3) your score in the College English Test-6 is over 550, or over 70 in the Test for English Majors Grade Four, you are invited to take part in this study. A total of 20 students at Sun Yat-sen University will be recruited for this study.

#### 4. Do I have to take part?

No. It is up to you to decide whether to take part. You can withdraw yourself from the research, without giving a reason, and without negative consequences, by advising me of this decision. The deadline by which you can withdraw any information you have contributed to the research is 8<sup>th</sup> June (before data are anonymised). If you decide to withdraw, all the data that have been collected from you will be deleted.

#### 5. What will happen to me if I take part in the research?

Participants will receive a consent form via email before the study starts. They will take part in this online study for four sessions. Each session will take about 20 minutes.

In the first and second sessions, participants will watch a 15-minute pre-recorded course video and then complete a post-test to assess their comprehension of the subject knowledge that is delivered in the recording. In the third and fourth sessions, participants will be asked to complete a delayed post-test and a questionnaire about their feelings about EMI courses.

#### 6. What are the possible disadvantages and risks in taking part?

The post-test and delayed post-test may place a burden on participants. In order to eliminate their burden of taking the tests, participants will be told that all the answers will be submitted and scored anonymously, and there are neither rewards nor punishment.

Each participant will get a unique number for identification without using their name and will be quoted directly using a pseudonym in this study. The participants' other personal information, including name, age and gender, will be stored separately from other research data on the University of Oxford Nexus365 OneDrive for Business file storage service, to which the researcher, her supervisor and other Oxford University staff involved with data control have access.

**7. Are there any benefits in taking part?**

While there are no significant benefits for those people participating in the research, it is hoped that participants can gain specific subject knowledge and have a deeper understanding of EMI programs.

**8. What information will be collected and why is the collection of this information relevant for achieving the research objectives?**

Participants' personal information, including name, age, gender and email address will be collected for identification and contact.

The task results of the post-test and the delayed post-test, and the questionnaires will be collected to analyze the effectiveness of the use of L1 in EMI courses in order to answer research questions.

The researcher, her supervisor and other Oxford University staff involved with data control will have access to the research data.

Identifiable data (including consent forms) will be stored on the University of Oxford Nexus365 OneDrive for Business file storage service. Other research data will be stored for three years after publication or public release of the work of the research.

**9. Will the research be published? Could I be identified from any publications or other research outputs?**

The findings from the research will be written up in a dissertation. It will not be possible for participants to be identified from the outputs.

**10. Data Protection**

The University of Oxford is the data controller with respect to your personal data, and as such will determine how your personal data is used in the research. The University will process your personal data for the purpose of the research outlined above. Research is a task that is performed in the public interest. Further information about your rights with respect to your personal data is available from the University's Information Compliance web site at <https://compliance.admin.ox.ac.uk/individual-rights>.

**11. Who has reviewed this research?**

This research has received ethics approval from a subcommittee of the University of Oxford Central University Research Ethics Committee. (Ethics reference: EDUC\_C1A\_24\_095).

**12. Who do I contact if I have a concern about the research or I wish to complain?**

If you have a concern about any aspect of this research, please contact [redacted] at [redacted] and I will do our best to answer your query. I will acknowledge your concern within 10 working days and give you an indication of how it will be dealt with. If you remain unhappy or wish to make a formal complaint, please contact the Chair of the Research Ethics Committee at the University of Oxford who will seek to resolve the matter as soon as possible:

The Chair, Social Sciences & Humanities Interdivisional Research Ethics Committee;  
Email: [ethics@socsci.ox.ac.uk](mailto:ethics@socsci.ox.ac.uk); Address: Research Services, University of Oxford, Boundary Brook House, Churchill Drive, Headington, Oxford OX3 7GB

**13. Further Information and Contact Details**

If you would like to discuss the research with someone beforehand (or if you have questions afterwards), please contact:

[redacted]  
Department of Education  
15 Norham Gardens, Oxford, OX2 6PY  
University tel: +44 (0) 1865 274024  
University email: [redacted]

## 8.7.4 Email Consent Script



### SAMPLE EMAIL CONSENT SCRIPT

Please read the statements below. If you are happy with all of the statements, please copy and paste them into an email and send it to me at [REDACTED]. This will be considered to constitute giving your consent to participate in the study.

If you have any questions about the research or the statements below, please do not hesitate to contact me.

I confirm that I have read and understand the information sheet for the study *The Effectiveness of the Use of L1 in EMI Courses on Disciplinary Knowledge Acquisition in Higher Education in China*. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

I understand that my participation is voluntary and that I am free to withdraw before 8<sup>th</sup> June (before data are anonymised), without giving any reason, and without any adverse consequences or penalty.

I understand what will happen to my data.

I give permission for the researcher(s) to quote me directly using a pseudonym.

I give permission for the researcher(s) to re-contact me to clarify information.

I agree for anonymised research data collected in this study to be used in other research studies.

I am happy to take part in the research.

## 8.8 SPSS Outputs

### 8.8.1 Full Descriptive Statistics Table for Post-test and Delayed Post-test

Group		Statistic	Std. Error
Comparison	posttest	Mean	92.2222
		95% Confidence Interval for Mean	1.46986
		Lower Bound	88.8327
		Upper Bound	95.6117
		5% Trimmed Mean	92.1914
		Median	90.0000
		Variance	19.444
		Std. Deviation	4.40959

	Minimum		85.00	
	Maximum		100.00	
	Range		15.00	
	Interquartile Range		5.00	
	Skewness		.214	.717
	Kurtosis		.144	1.400
delayedposttest	Mean		75.5556	4.28535
	95% Confidence Interval for Mean	Lower Bound	65.6735	
		Upper Bound	85.4376	
	5% Trimmed Mean		75.3395	
	Median		75.0000	
	Variance		165.278	
	Std. Deviation		12.85604	
	Minimum		60.00	
	Maximum		95.00	
	Range		35.00	
	Interquartile Range		25.00	
	Skewness		.183	.717
	Kurtosis		-1.382	1.400
Experimental posttest	Mean		88.5000	1.97906
	95% Confidence Interval for Mean	Lower Bound	84.0231	
		Upper Bound	92.9769	
	5% Trimmed Mean		88.3333	
	Median		85.0000	
	Variance		39.167	
	Std. Deviation		6.25833	
	Minimum		80.00	
	Maximum		100.00	

	Range		20.00	
	Interquartile Range		10.00	
	Skewness		.705	.687
	Kurtosis		-.493	1.334
delayedposttest	Mean		71.0000	5.41603
	95% Confidence Interval for Mean	Lower Bound	58.7481	
		Upper Bound	83.2519	
	5% Trimmed Mean		70.5556	
	Median		67.5000	
	Variance		293.333	
	Std. Deviation		17.12698	
	Minimum		50.00	
	Maximum		100.00	
	Range		50.00	
	Interquartile Range		32.50	
	Skewness		.638	.687
	Kurtosis		-.774	1.334

### 8.8.2 Full Descriptive Statistics Table for English-only and L1-mediated Groups

	Group		Statistic	Std. Error	
Difference	English-only	Mean	16.6667	3.81881	
		95% Confidence Interval for Mean	Lower Bound	7.8605	
			Upper Bound	25.4729	
		5% Trimmed Mean	17.1296		
		Median	15.0000		
		Variance	131.250		
		Std. Deviation	11.45644		
		Minimum	-5.00		
		Maximum	30.00		

	Range	35.00	
	Interquartile Range	17.50	
	Skewness	-.686	.717
	Kurtosis	.203	1.400
L1-mediated	Mean	17.5000	4.84481
	95% Confidence Interval for Lower Bound	6.5403	
	Mean	Upper Bound	28.4597
	5% Trimmed Mean	17.2222	
	Median	15.0000	
	Variance	234.722	
	Std. Deviation	15.32065	
	Minimum	.00	
	Maximum	40.00	
	Range	40.00	
	Interquartile Range	32.50	
	Skewness	.333	.687
	Kurtosis	-1.097	1.334