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Title

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Abstract

The study reported in this article investigated the linguistic challenges that students face at an English medium instruction (EMI) university in Turkey. The aims of the study were (1) to describe the challenges that students experience in their EMI classes; (2) to investigate how these challenges vary according to individual student characteristics; and (3) to validate a research instrument designed to explore academic language-related challenges in EMI contexts. Data were collected from undergraduate students (N=498) using an online questionnaire, which had a structure based on challenges with respect to reading, writing, speaking, and listening. The analysis revealed that students found writing and speaking to be the most challenging areas in their EMI classes. The study also found significant differences in the challenges reported by students with respect to academic discipline, L1 background, prior EMI experience, and the type of exam taken to meet the university's language proficiency requirements. Implications are discussed with respect to EAP support for students and L2 proficiency entry requirements for EMI programs.

Keywords

1. Introduction

There has been a growing trend towards teaching academic subjects in English at universities in countries where English is not an official language (Wächter & Maiworm, 2014; Macaro, Curle, Pun, An and Dearden, 2018). Englishization of higher education (HE) is a current global phenomenon (Rose and McKinley, 2018; Galloway, Numajiri & Rees, 2020), and Turkey is no exception in this global trend (Kırkgöz, 2009a; Selvi, 2014). Although the history of English Medium Instruction (EMI) in Turkey can be traced back to the founding of Robert College in 1863, the country has seen a rapid growth over the last two decades in the number of universities which offer EMI programmes (Kırkgöz, 2014; Aslan, 2018). In 2019, nearly 750 bachelor programmes were taught through English at public and private universities in Turkey (ÖSYM 2019), with growth spurred on by a doubling of the number of HE institutions from 2005 to 2010 (Günay & Günay, 2011).

The expansion of EMI programs in university settings signals a shift from studying English as foreign language to using English for the study of academic content. However, the implementation of EMI requires more than "simply switching the vehicle of communication and continuing as usual" (Bradford, 2016, p. 340). A shift to using English as the medium of instruction is likely to be accompanied with linguistic challenges (Galloway & Ruegg, 2020), particularly in a context like Turkey, where previous studies have suggested that students often enter EMI departments with limited English proficiency (Ekoç 2018; Kırkgöz, 2009b), and many students often enter a preparatory year of study (see Macaro, 2018). However, the nature of these linguistic challenges and the degree to which students with different individual and group characteristics experience them remain unclear. The study presented in this paper aims to address this need by investigating the language-related challenges that

students face at an EMI university in Turkey. Understanding such challenges can help to inform EAP preparatory programs to better support students for the study of academic content in English. It also aims to confirm the structure of EMI linguistic challenges in order to ascertain whether challenges are grouped around the four English academic skills of reading, writing, speaking and listening, and to assess whether these challenges have a predictive effect on success in EMI courses.

2. Background to the study

2.1 Language and content in EMI

EMI refers to '[t]he use of the English language to teach academic subjects (other than English itself) in countries or jurisdictions where the first language (L1) of the majority of the populations is not English' (Macaro, 2018, p. 19). As such, the primary objective of an EMI program is generally content learning, although language learning may be a perceived or implied benefit. There is an ongoing debate in the EMI research literature as to whether the effectiveness of EMI programs should be measured in terms language learning, content learning, or both (e.g. Macaro et al., 2018; Evans, 2002; Hu, Li & Lei, 2014). Even though most definitions of EMI make no claim to language learning, "a widely purported benefit of EMI is that it kills two birds with one stone; in other words, students simultaneously acquire both English and content knowledge" (Rose et al., 2020a, p. 2150). However empirical research investigating the relationship between EMI and language learning has yielded mixed results. Galloway et al. (2017) found in the Japanese and Chinese HE context that students saw a number of perceived benefits to EMI such as maintaining the quality of content learning and improving English language knowledge at the same time, indicating dual learning outcomes, although the study also found that staff and students had

different expectations towards the purpose of EMI in terms of language learning outcomes. Other studies, however, have yielded less promising results: a study by Lei and Hu (2014) conducted at a Chinese university revealed that EMI students were dissatisfied with both the quality of academic content taught and the limited linguistic benefits they gained through EMI. Yang's (2015) study found that while students in Taiwan achieved some improvements in their receptive and productive language skills throughout their EMI studies, they did not show the same improvement in their content comprehension and knowledge. These results corroborate the findings of other studies that suggest EMI programs may fall short of their often perceived dual-focused educational aims (e.g. Chapple, 2015; Lei & Hu, 2014; Sert, 2008; Jiang, Zhang & May, 2019).

While evidence with respect to the effectiveness of EMI for both language and content learning remains unclear, Macaro et al. (2018) argue that EMI "should demonstrate some improvement in English language learning and, AT THE VERY LEAST, present no long-term cost to academic content learning" (p. 10, emphasis in original). To this end, an understanding of the language-related challenges that students face in EMI contexts is imperative to ensure successful content learning.

2.2 Language challenges in EMI

Previous research has attempted to identify the primary language-related challenges that students encounter in EMI courses. Studies comparing content learning in EMI and first-language medium of instruction (L1 MoI) contexts have highlighted the linguistic challenges faced by EMI students. In a study that compared EMI and L1 MoI in Turkey, Sert (2008) found that EMI students had difficulty understanding questions, answering them properly, and engaging in meaningful communicative tasks in English. Similarly,

Hellekjær (2010) found that EMI students' listening comprehension was lower than L1 MoI students at two German universities due to unfamiliar words used in EMI lectures. In a study that explored the self-reported content comprehension of EMI and non-EMI students at a Spanish university, Dafouz et al. (2014) found that the perceived content comprehension of EMI students was lower than non-EMI students; however, no significant differences were found between the two groups' official grades. These results suggest that students experience—or at least perceive—greater challenges in EMI compared to L1 MoI contexts.

The results of a relatively small number of studies put vocabulary knowledge at the top of the list of challenges that students experience in EMI settings (Başıbek et al., 2014; Chang, 2010; Evans & Green, 2007; Kırkgöz, 2009b). Evans and Green's (2007) study, which was conducted with university students in Hong Kong, found that students' inadequate vocabulary knowledge, including technical vocabulary, was a major barrier for understanding academic content in EMI. Similarly, Chang (2010) found that Taiwanese EMI students, particularly from technical disciplines, had difficulties understanding concepts and showed poor academic performance because of their limited vocabulary knowledge. In an investigation of EMI research across four countries in Europe, Airey et al. (2017) concluded that EMI programs have disciplinary-specific literacy goals and needs. That is, the language required to learn medical science through English may be vastly different to the language needed in the social sciences. Similarly, Kuteeva and Airey (2014) have argued that general EMI policies "fail to take into consideration fundamental disciplinary differences and their potential impact on language use" (p. 533).

In addition to vocabulary, research has suggested that students experience a number of challenges related to speaking such as difficulties in asking and answering of questions, as

well as challenges related to listening, such as difficulty following lectures (Airey and Linder, 2006). Other studies have reported that students experienced difficulty taking notes from academic texts (Hellekjær, 2010) and understanding lecturers' accents (Tange, 2010). In a large-scale mixed-methods study carried out by Evans and Morrison (2011) in Hong Kong, EMI students (N=3009) were found to encounter a range of writing-related difficulties, such as planning written assignments and expressing ideas in correct English. The survey results from Evans and Morrison's study revealed that students experienced difficulty 'taking brief, clear notes' (a listening challenge) and 'understanding lecturers' accents' (a listening challenge). In the qualitative phase of the study, 53 interviews were conducted with students who reported that, apart from a lack of technical vocabulary knowledge, 'understanding the main ideas of lectures' (a listening challenge) and 'achieving an appropriate writing style' (a writing challenge) were the most difficult aspects associated with EMI (Evans & Morrison, 2011).

While the body of research described above has investigated language-related challenges in EMI contexts, the relationship between these challenges and learner characteristics remains under-researched. Previous research has attempted to measure the language needs and challenges of EMI students through questionnaires (e.g. Jiang et al., 2019; Tatzl, 2011). However, contextual differences between university programs and learner characteristics, coupled with the use of non-compatible questionnaires, make it difficult to arrive at meaningful comparisons. A recent systematic review of EMI (Macaro et al., 2018) highlights a need for more comparative research, necessitating the need to develop validated instruments that can be used across contexts.

2.3 Proficiency requirements for EMI in Turkey

Research exploring the impact of EMI on linguistic and content knowledge presumes that students should have at least a certain level of language proficiency before entering EMI classes (e.g. Aguilar and Munoz, 2014), yet how much English proficiency is necessary for EMI study remains unclear (Airey and Linder, 2006; Aizawa et al., 2020; Macaro et al., 2019). Research on EMI students' language proficiency in Turkey suggests a picture of "deep concern in terms of level of English in general and vocabulary knowledge in particular" (Macaro et al., 2018, p. 52). While language proficiency is not a pre-requisite for admission to EMI programs in Turkey, students must meet the L2 proficiency requirements of their HEI before enrolling in EMI department courses. Turkish universities follow the English preparatory model of language support (see Macaro, 2018), in which students who do not meet the prerequisite language requirements enrol in a one-year, intensive English language course before entering their EMI classes. The specific level of language proficiency that students are expected to obtain for EMI programs varies across universities in Turkey. The university at which this study was conducted required students to achieve approximately a B2 level of English proficiency according to the Common European Framework of Reference (CEFR), or an IELTS score of 5.5 or TOEFL score of 74, before enrolling to EMI courses. For most students in Turkey, this level of proficiency is achieved through the year-long English preparatory program (EPP). However, the quality and effectiveness of EPPs in Turkey has been questioned: although some studies (e.g. Öner and Mede, 2015) have provided evidence that the academic needs of EMI students were met by EPPs, others reported contrary findings (e.g. Kırkgöz, 2009b; Yıldız, Soruç & Griffiths, 2017). Inconclusive evidence on the effective of the EPP system suggests a need for further

research investigating the linguistic challenges faced by students in EMI courses, and whether the EPP system properly prepares students to overcome such challenges.

3. Methodology

The current study addresses the following research questions:

(1) What language-related challenges do students face in the Turkish EMI context?

    1a) Are these challenges structured around the academic skills of listening, reading, writing, and speaking?

(2) Do these challenges differ according to gender, field of study, year of study, L1 background, EMI experience before university, and language proficiency test?

(3) Do language-related challenges predict success in EMI courses?

3.1 Data collection instrument

A questionnaire consisting of 51 items was used to collect data. Five items related to demographic information (field of study, year of study, gender, L1 background, and prior EMI experience), and one item requested an English language proficiency test score from students. The full questionnaire is available on the IRIS database (https://www.iris-database.org/), and as an additional online document connected to the electronic version of this paper. There were two Likert scale items related to self-reported academic success ('I perform well in my EMI courses'; 'My learning of academic content through my EMI courses is successful'). Due to ethical restrictions at the data collection site, direct measures of success such as exam scores and grade point averages (GPA) were not attainable. The use of self-reported measures of academic success represents a limitation in this study, and the

findings with respect to success in EMI courses (RQ3) are interpreted as students' self-reported success.

To measure the challenges that students experienced in EMI classes 45 items were adopted from Evans and Morrison's (2011) questionnaire on EMI linguistic challenges. The scale used in the questionnaire aimed to measure linguistic challenges with respect to four constructs: writing, speaking, listening and reading. The questionnaire items pertaining to these four constructs are reported in Table 2. Responses to the items were recorded on a 7-point Likert-type scale, ranging from very difficult (1) to very easy (7). The scale was developed specifically for an EMI university setting by Evans and Morrison (2011) in Hong Kong, and it has been used by other researchers in different EMI contexts including Japan and China (Aizawa et al., 2020; Rose et al., 2020b). However, to our knowledge, this is the first study to confirm, by means of confirmatory factor analysis (CFA), that the instrument measures the four types of linguistic challenges that it intends to capture. Although data for this study were collected from only one HEI context, the study offers a validated instrument which can be used for cross-country comparison. Thus, the validation of the assumed structure of the questionnaire may lead to greater comparative research.

3.2 Setting

Data were collected from a university in Turkey, which was chosen due to its suitability as a research site (the university offered undergraduate programs in multiple disciplines) and because of the university's accessibility by the lead researcher. At the university, students were required to meet the L2 proficiency requirements either by passing an in-house exam prepared by the EPP or by submitting an exam score from TOEFL or IELTS, with equivalency scores set by the university. Students who do not pass the

university proficiency exam (UNIP) or submit an equivalent TOEFL or IELTS are required to enrol in and successfully complete the EPP before entering their EMI departmental classes. To successfully complete the EPP, students must achieve the minimum passing score on the UNIP. At the time of data collection at this university, a minimum score of 60 was required to pass the UNIP, and minimum scores of IELTS 5.5 or TOEFL 74 were required. The current study compared students' language-related challenges with respect to which L2 proficiency exam was submitted to meet the proficiency standards of the university. In other words, this study compared challenges faced by students who met the L2 proficiency standards by passing the UNIP and students who submitted external exams. The findings from this analysis offer insight into the reliability of assessment through the EPP system and the L2 proficiency requirements established by the university.

3.3 Participants

A total of 512 students from an EMI university in Istanbul completed the questionnaire. However, due to missing data from 14 students, 498 responses were analysed in this study to address the research questions. The participants were enrolled in EMI undergraduate (4-year) programs in the Social Sciences, Engineering, and Medical Faculties. About half of the participants were studying a course in the Social Sciences. While 336 (67.4%) participants were Turkish students with L1 Turkish background, 162 (32.6%) participants were international students with an L1 background other than Turkish. These international students were mostly from the Middle East (i.e. Syria, Iraq, Iran, Jordan, Lebanon, Saudi Arabia), Central Asia (i.e. Azerbaijan, Uzbekistan, Turkmenistan), Russia, North Africa (i.e. Morocco, Algeria, Libya, Egypt), the Republic of South Africa, and Europe (particularly children of Turkish workers who were born in Germany, Austria, France

and Belgium). A breakdown of international students' language backgrounds is provided in the Appendix. In terms of gender, 282 (56.6%) participants were female and the remaining 216 (43.4%) male. All participants satisfied the English proficiency requirements of the university either by attending the university's EPP and passing its proficiency exam (UNIP) or by obtaining a satisfactory score on the TOEFL or IELTS exams. In terms of how they met the proficiency criteria, 357 (72.0%) students passed the UNIP, 83 (16.0%) submitted TOEFL scores, and 58 (12.0%) took the IELTS exam. The mean score for IELTS was 5.65 (SD=0.95) and for the TOEFL iBT was 79.46 (SD=8.17).

In response to the item on previous EMI experience, 234 (47%) participants reported that they had studied academic subjects in English before university, whereas 264 (53%) participants reported no experience with EMI before university. Table 1 summarizes the demographics of the participants.

Table 1: Participant demographics (n = 498)

Variable	Category	Frequency	Percentage (%)
Gender	Female	282	56.6
	Male	216	43.4
Field of study	Social Sciences (*e.g.* economics, business, communication, law, education)	273	54.8
	Engineering (*e.g.* engineering, architecture and design)	171	34.3
	Medicine & Health Sciences	54	10.9
Year of study	1st year	57	11.4
	2nd year	78	15.7
	3rd year	114	22.9
	4th year	249	50.0
L1 Background	Turkish	336	67.4
	Other than Turkish	162	32.6
Prior EMI experience	Yes	234	47.0
	No	264	53.0
English language proficiency test	UNIP	357	72.0
	TOEFL	83	16.0
	IELTS	58	12.0

3.4 Data collection and analytical procedures

The questionnaire was first piloted with 50 students enrolled in EMI programs. The students provided positive feedback with respect to the length, clarity, and comprehensibility of the questionnaire. Moreover, initial analysis of assumed factors yielded acceptable Cronbach's alpha values, indicating that the items were being answered consistently by participants. For the main study, the questionnaire was administered online. After obtaining the requisite permission from the university administration, the link to the questionnaire was shared with the participants using the e-mail database of the Student Affairs Department in April 2019. Two follow-up reminders were sent via email in the weeks following the initial distribution of the questionnaire to increase the response rate. The link to the questionnaire was closed at the end of June 2019.

4. Results

4.1 The structure of language-related challenges

First, Cronbach's alpha coefficients were calculated to test the reliability and internal consistency of the research instrument. A satisfactory Cronbach's alpha value was found for the overall scale (α= 0.974) and for each of the assumed four constructs related to student challenges (writing α= 0.971; speaking α= 0.966; listening α= 0.961; reading α= 0.953). The internal reliability of the self-reported EMI success items was also excellent (α=0.907). This indicated that the questionnaire items did appear to reliably be measuring each presumed construct.

As a main step for investigating the research instrument, confirmatory factor analysis (CFA) was conducted to examine how the questionnaire items were related with their pre-determined factors (reading, writing, listening, and speaking). CFA allowed us to

confirm the assumed structure of the data and examine covariance between the four

factors. In other words, CFA was used to assess the validity of the research instrument by

confirming that the instrument was measuring the four factors it intended to measure. CFA

was used to examine whether the questionnaire items corresponded with their intended

constructs by looking at their standardised regression weights (see Figure 1). Moreover,

"the causal relations between latent factors and their observed indicator variables" (Mueller

and Hancock, 2001, p. 5240) were explored, and the factor loadings of the items were

scrutinized. Based on fitness indices[1], it can be concluded that fitness required in the model,

if not perfect, was achieved, and the model was thus confirmed. This indicated that

questionnaire items could be used as a valid measure of overall linguistic challenges in an

EMI context, and that each of the four constructs could be used as independent measures

of challenges associated with reading, writing, speaking and listening in EMI.

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[1] *The indices used to explore the fitness of the model were parsimonious fit index [χ2/df: 3.979], comparative fit index [CFI: 0.943], goodness of fit index [GFI: 0.922], route mean square error of approximation [RMSEA: 0.063], non-normed fit index [NNFI: 0.936] and the Tucker-Lewis index [TLI: 0.958].*
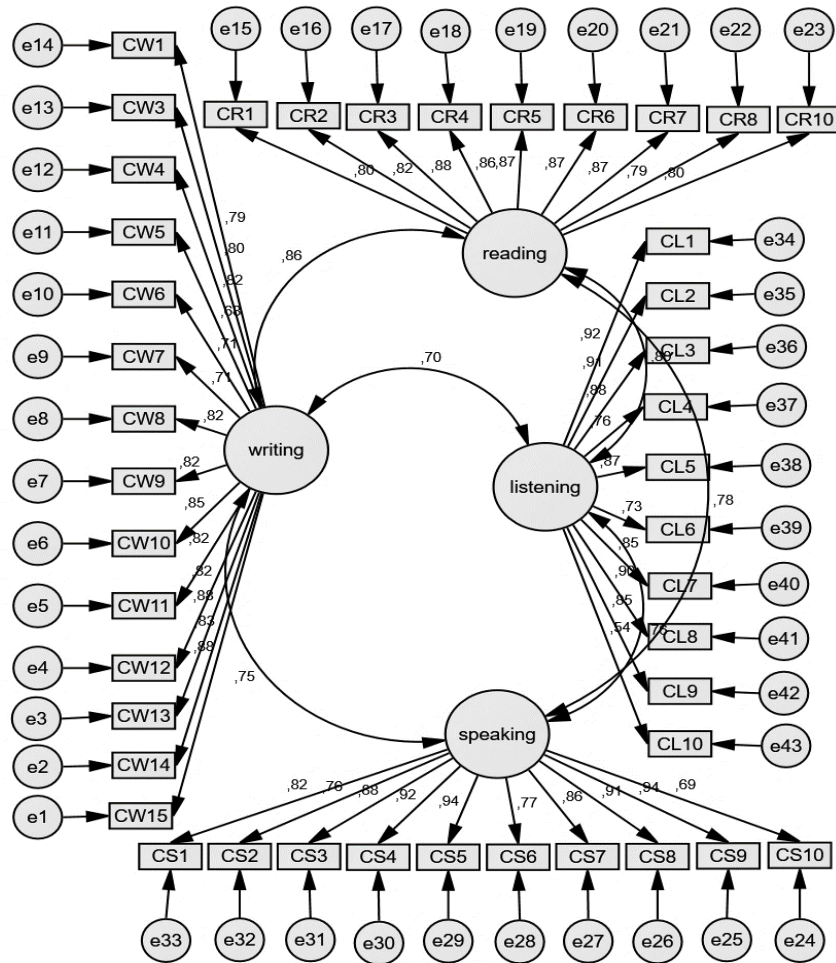
Figure 1. Factor structure of the student challenges scale.

After confirming the structure of the questionnaire items through CFA, tests of normality were conducted on the data pertaining to student challenges with respect to reading, writing, speaking and listening in order to check that the assumptions for further statistical analysis were met. The data were found to be normally distributed for each construct analysed in this study through an assessment of skewness and kurtosis and by conducting Kolmogorov-Smirnov and Shapiro-Wilk tests.

Non-response bias was examined by comparing the language proficiency scores of early respondents (n_{early} = 205) and late respondents (n_{late} = 293) via paired samples t-tests (Hair et al. 2009). The results of paired sample t-tests revealed no significant differences between the early and late respondents' language proficiency test scores [(UNIP: t = -1.380,

p = 0.170), (TOEFL: t = -0.323, p = 0.749), (IELTS: t = 0.914, p = 0.370)]. Therefore, non-

response bias was not considered to be a problem in this study. These steps indicated that

the questionnaire data pertaining to challenges and proficiency were suitable for further

analysis.

4.2 Language-related challenges in the Turkish EMI context

In order to answer RQ1, student responses to the 45 items measuring challenges in

relation to writing, reading, speaking and listening in EMI classes were analysed. The mean

scores of student responses for each item are presented in Table 2, with lower means

indicating that students experienced greater difficulty.

Table 2: Student challenges (n= 498; responses of 1 = 'very difficult', 7 = 'very easy')

WRITING Statement	Mean	SD
CW1 Planning written assignments	4.86	1.46
CW2 Expressing ideas in correct English	4.93	1.62
CW3 Revising written work	5.16	1.54
CW4 Using appropriate academic style	**4.53**	1.57
CW5 Writing a bibliography/references section	4.70	1.58
CW6 Proofreading written work	4.77	1.57
CW7 Referring to sources in written work	5.01	1.54
CW8 Summarising/paraphrasing ideas in sources	5.00	1.60
CW9 Organising ideas in coherent paragraphs	4.98	1.49
CW10 Expressing ideas clearly and logically	5.12	1.45
CW11 Linking ideas from different sources	5.00	1.39
CW12 Writing the introduction to an assignment	5.21	1.50
CW13 Writing the body of an assignment	5.01	1.56
CW14 Writing the conclusion to an assignment	5.24	1.49
CW15 Linking sentences smoothly	4.96	1.55
Overall writing	*4.97*	*1.54*
READING Statement	Mean	SD
CR1 Understanding specific vocabulary	5.03	1.44
CR2 Working out the meaning of difficult words	**4.84**	1.55
CR3 Reading carefully to understand a text	5.47	1.40
CR4 Reading quickly to find specific information	5.26	1.46
CR5 Identifying supporting ideas and examples	5.12	1.38

CR6 Reading quickly to get overall meaning	5.15	1.51
CR7 Identifying the key ideas of a text	5.31	1.45
CR8 Taking brief, relevant notes	5.09	1.39
CR9 Using your own words when taking notes	5.45	1.53
CR10 Understanding the organisation of a text	5.44	1.38
Overall reading	*5.22*	*1.48*
SPEAKING		
Statement	**Mean**	**SD**
CS1 Speaking accurately (grammar)	4.74	1.65
CS2 Speaking clearly (pronunciation)	5.15	1.71
CS3 Presenting information/ideas	5.04	1.62
CS4 Participating actively in discussion	**4.69**	1.79
CS5 Communicating ideas fluently	4.83	1.76
CS6 Speaking from notes	5.54	1.49
CS7 Asking questions	5.03	1.80
CS8 Answering questions	4.93	1.73
CS9 Communicating ideas confidently	4.81	1.76
CS10 Using visual aids (e.g. PowerPoint)	5.52	1.58
Overall speaking	*5.03*	*1.71*
LISTENING		
Statement	**Mean**	**SD**
CL1 Understanding the main ideas of lectures	5.72	1.40
CL2 Understanding the overall organisation of lectures	5.70	1.32
CL3 Understanding key vocabulary	5.60	1.41
CL4 Taking brief, clear notes	5.40	1.50
CL5 Identifying supporting ideas and examples	5.38	1.42
CL6 Understanding lecturers' accents	5.39	1.44
CL7 Following a discussion	5.50	1.47
CL8 Identifying different views and ideas	5.53	1.42
CL9 Understanding questions	5.66	1.42
CL10 Understanding classmates' accents	**4.82**	1.70
Overall listening	*5.47*	*1.48*

All items received mean scores above the scale midpoint of '4' indicating that students, on average, did not report significant linguistic challenges with respect to any of the items. Based on the total mean scores of each item, participants indicated that writing (*M* = 4.97) and speaking (*M* = 5.03) were the most challenging areas, and they found listening (*M* = 5.47) and reading (*M* = 5.22) as the least challenging areas in their EMI courses. The findings revealed that students found 'using appropriate academic style' in writing, 'working out the meaning of difficult words' in reading, 'participating actively in discussion' in speaking, and 'understanding classmates' accents' in listening as the most

difficult elements for each skill respectively. These descriptive results suggest that students experience greater difficulty with respect to productive skills (e.g. writing and speaking) than receptive skills (e.g. reading and listening) and face challenges with academic English and engaging in class discussions.

4.3 Exploring challenges and individual/group differences

RQ2 explored the relationship between individual/group differences and challenges experienced in EMI contexts. Quantitative analysis was conducted to determine whether there were statistically significant differences between the mean scores of the questionnaire items based on the demographic variables of students' gender, academic discipline, year of study, L1 background, prior EMI experience, and language proficiency test.

4.3.1 Do the challenges faced by students differ according to gender?

To explore whether there was a difference in gender across the four challenges, ANOVA was conducted. Results revealed that there was a significant difference between 282 female (M = 5.641, SD = 1.205) and 216 male (M = 5.251, SD = 1.205) participants in terms of challenges with respect to listening in EMI classes (Table 3). Male participants found listening to EMI lectures significantly more challenging than their female counterparts (F= 12.806, p<0.001). No other difference was observed according to gender. These results indicate that gender did not clearly relate to challenges experienced by students in this EMI context, with the exception of listening.

Table 3. Student challenges according to gender (mean responses of 1 = 'very difficult', 7 = 'very easy')

		N	Mean	SD	F value	Sign.
CW	Female	282	5.041	1.352	1.934	Non-sign.
	Male	216	4.883	1.100		
CR	Female	282	5.294	1.317	3.864	Non-sign.
	Male	216	5.074	1.127		
CS	Female	282	5.030	1.587	0.001	Non-sign.
	Male	216	5.033	1.306		
CL	Female	282	5.641	1.205	12.806***	p<0.001
	Male	216	5.251	1.205		

***Significant at the 0.001 level

4.3.2 Do the challenges faced by students differ according to field of study?

Further analyses (MANOVA) were conducted to explore group differences in language-related challenges according to the discipline being studied. Students were grouped into the three major disciplines based on the three major faculties of the university: social sciences, engineering, and medicine. Results revealed the existence of some significant differences in challenges faced by students according to their field of study (Table 4). Post-hoc tests revealed that students who studied a subject in the Social Sciences Faculty found writing and reading in EMI classes more challenging than engineering students. No differences were observed with respect to speaking and listening challenges in EMI classes according to the participants' field of study. Thus, there is some evidence that students in the social sciences might encounter greater challenges in terms of reading and writing texts in their disciplines of study, compared to the academic discipline of engineering.

Table 4. Student challenges according to academic discipline (mean responses of 1 = 'very difficult', 7 = 'very easy')

	Academic discipline	Mean	SD	N	(I) Faculty	(J) Faculty	Mean difference (I – J)	Std. Error	Sign.
CW	Social sciences	4.874	1.230	273	Social sciences	Engineering	-0.259*	0.121	p<0.05
	Engineering	5.134	1.226	171		Medicine	-0.085	0.185	Non-sign.
	Medicine	4.960	1.391	54					
CR	Social sciences	5.116	1.241	273	Social sciences	Engineering	-0.266*	0.120	p<0.05
	Engineering	5.382	1.231	171		Medicine	0.079	0.184	Non-sign.
	Medicine	5.037	1.236	54					
CS	Social sciences	4.937	1.546	273	Social sciences	Engineering	-0.274	0.143	Non-sign.
	Engineering	5.212	1.332	171		Medicine	-0.001	0.218	Non-sign.
	Medicine	4.938	1.469	54					
CL	Social sciences	5.374	1.256	273	Social sciences	Engineering	-0.177	0.118	Non-sign.
	Engineering	5.552	1.239	171		Medicine	-0.336	0.181	Non-sign.
	Medicine	5.711	0.886	54					

*Significant at the 0.05 level

4.3.3 Do the challenges faced by students differ according to year of study?

Further analyses (MANOVA) were conducted to explore group differences in language-related challenges according to the year of study to investigate whether challenges dissipated over a period of EMI study. MANOVA results revealed that second-year and fourth-year students experienced reading-related challenges significantly different from first-year students. Second-year (M = 5.106, SD = 1.466) and fourth-year (M = 5.160, SD = 1.180) students found elements of reading in EMI classes more challenging than first-year (M = 5.532, SD = 1.362) students as shown in Table 5. These results offer some evidence that EMI language related challenges do not dissipate over the course of the degree. To the contrary, it appears that the students experience greater difficulties in reading as the content of their studies becomes more advanced in later years, although the nature of this relationship is not clear across all four years of study.

Table 5. Student challenges according to year of study (mean responses of 1 = 'very difficult', 7 = 'very easy')

	Year of study	Mean	SD	N	(I) Year	(J) Year	Mean difference (I – J)	Std. Error	Sign.
CW	1	5.225	1.123	57	1	2	0.401	0.217	Non-sign.
	2	4.824	1.516	78		3	0.263	0.202	Non-sign.
	3	4.962	1.345	114		4	0.259	0.183	Non-sign.
	4	4.966	1.135	249					
CR	1	5.532	1.362	57	1	2	0.425*	0.216	p<0.05
	2	5.106	1.466	78		3	0.353	0.201	Non-sign.
	3	5.178	1.131	114		4	0.371*	0.182	p<0.05
	4	5.160	1.180	249					
CS	1	5.347	1.458	57	1	2	0.397	0.256	Non-sign.
	2	4.950	1.504	78		3	0.357	0.238	Non-sign.
	3	4.989	1.480	114		4	0.342	0.216	Non-sign.
	4	5.004	1.458	249					
CL	1	5.752	0.811	57	1	2	0.241	0.212	Non-sign.
	2	5.511	1.400	78		3	0.297	0.197	Non-sign.
	3	5.455	1.127	114		4	0.349	0.178	Non-sign.
	4	5.403	1.273	249					

*Significant at the 0.05 level

4.3.4 Do the challenges faced by students differ according to L1 background?

Further analysis was conducted to investigate differences in EMI language-related challenges and the students' L1 background. The findings showed statistically significant differences between the mean scores of L1 Turkish students and students whose L1 was a language other than Turkish (e.g. international students) with respect to challenges related to writing (F= 71.040, p<0.001), reading (F= 54.051, p<0.001), speaking (F= 106.095, p<0.001), and listening (F= 27.702, p<0.001) in EMI classes (Table 6). These results indicate that Turkish students considered EMI courses much more linguistically challenging than international students, meaning international students in this population may be more linguistically prepared for EMI studies.

Table 6. Student challenges according to L1 background (mean responses of 1 = 'very difficult', 7 = 'very easy')

	L1 background	N	Mean	SD	F value	Sign.
CW	Turkish	336	4.665	1.224	71.040***	p<0.001
	International	162	5.609	1.051		
CR	Turkish	336	4.928	1.259	54.051***	p<0.001
	International	162	5.759	0.999		
CS	Turkish	336	4.603	1.469	106.095***	p<0.001
	International	162	5.920	1.005		
CL	Turkish	336	5.277	1.289	27.702***	p<0.001
	International	162	5.875	0.943		

***Significant at the 0.001 level

4.3.5 Do the challenges faced by students differ according to prior EMI experience?

Next, analysis was conducted to investigate differences in EMI language-related challenges and the students' previous experience studying through English. The results, shown in Table 7, revealed statistically significantly differences between students who studied academic content in English before university and those who did not with respect to writing (F= 16.183, p<0.001), reading (F= 7.669, p<0.001), speaking (F= 20.770, p<0.001), and listening (F= 10.243, p<0.001) challenges. Therefore, participants who had studied in English before university did not consider EMI as difficult as their peers who encountered EMI courses for the first time at university.

Table 7. Student challenges according to prior EMI experience (mean responses of 1 = 'very difficult', 7 = 'very easy')

	Subjects studied before university	Mean	SD	N	F value	Sign.
CW	Yes	5.208	1.185	234	16.183***	p<0.001
	No	4.763	1.271	264		
CR	Yes	5.361	1.196	234	7.669***	p<0.001
	No	5.054	1.267	264		
CS	Yes	5.344	1.395	234	20.770***	p<0.001
	No	4.754	1.483	264		
CL	Yes	5.656	0.978	234	10.243***	p<0.001

	No	5.309	1.380	264		

***Significant at the 0.001 level

4.3.6 Do the challenges faced by students differ according to language proficiency test scores?

Finally, the challenges experienced by students in their EMI classes were compared according to which language proficiency test the students submitted to meet the university's L2 proficiency requirement. As reported in Table 8, the ANOVA results revealed that students who took the proficiency exam administered by the university's EPP (UNIP; M = 4.670, SD = 1.217) reported more difficulty across skill areas than students who submitted TOEFL (M = 5.433, SD = 1.082) and IELTS (M = 5.499, SD = 1.202) exam scores. No significant differences were found in the challenges experienced by TOEFL- and IELTS-takers. Thus, participants who met the L2 proficiency criteria by passing UNIP experienced more language-related challenges in their EMI courses than students who met the L2 proficiency criteria by passing an external exam. These results suggest that the benchmark for the in-house exam may not be calibrated in line with its intended equivalency scores on the TOEFL and IELTS exam. Moreover, because UNIP scores were submitted by students who completed the EPP, these results raise questions about the effectiveness of the EPP in preparing students for the linguistic challenges of EMI study.

Table 8. Student challenges according to language proficiency test (mean responses of 1 = 'very difficult', 7 = 'very easy')

	Test scores	Mean	SD	N	(I) Test score	(J) Test score	Mean difference (I – J)	Std. Error	Sign.
CW	UNIP	4.670	1.217	357	UNIP	IELTS	-0.829*	0.137	p<0.05

	IELTS	5.499	1.202	58		TOEFL	-0.763*	0.142	p<0.05
	TOEFL	5.433	1.082	83					
CR	UNIP	4.872	1.261	357	UNIP	IELTS	-0.857*	0.135	p<0.05
	IELTS	5.730	1.083	58		TOEFL	-0.860*	0.140	p<0.05
	TOEFL	5.733	0.921	83					
CS	UNIP	4.668	1.419	357	UNIP	IELTS	-1.092*	0.161	p<0.05
	IELTS	5.760	1.329	58		TOEFL	-0.812*	0.167	p<0.05
	TOEFL	5.480	1.383	83					
CL	UNIP	5.209	1.243	357	UNIP	IELTS	-0.778*	0.135	p<0.05
	IELTS	5.987	1.156	58		TOEFL	-0.597*	0.140	p<0.05
	TOEFL	5.806	0.917	83					

*Significant at the 0.05 level

4.4 Predictive ability of the challenges questionnaire

The relationship between student challenges and self-reported academic success in EMI was explored via regression analyses. Regression analysis can suggest the amount that a construct holds influence over another. For example, it can answer the question, how much do students' language related challenges influence their success in EMI classes? First, four separate linear regression analyses were conducted for each challenge construct to best understand their individual predictive abilities on performance. Then, the impact of all the combined challenges on self-reported academic success was tested by another regression analysis.

A significant relationship between writing-related challenges and academic success was found [$F_{(1, 496)}$= 424.150, $p<0.001$), Adj. R^2 of 0.460]. Thus, academic writing challenges were considered as a significant predictor of academic success in EMI (β= 0.679, $p<0.001$). A significant relationship between reading-related challenges and academic success was also found [$F_{(1, 496)}$= 276.971, $p<0.001$), Adj. R^2 of 0.357]. Thus, academic reading challenges were also considered as a significant predictor of academic success in EMI (β= 0.599, $p<0.001$), but with less explanatory power of variance of success measures. A significant relationship between speaking-related challenges and academic success was also found [$F_{(1, 496)}$= 497.284, β= 0.708, $p<0.001$), with an Adj. R^2 of 0.500], thus explaining 50% of the variance in

EMI success. Finally, a significant relationship between listening-related challenges and academic success was found [$F_{(1, 496)}= 352.881$, $p<0.001$), Adj. R^2 of 0.415], and as such was also as a significant predictor of academic success in EMI ($\beta= 0.645$, $p<0.001$).

To explore all challenges together, the mean score of each of the four challenge constructs was amalgamated into a composite academic language-related challenge construct (CHAL), which represented all students' language-related challenges. Then, the relationship between all student challenges together and self-reported academic success was investigated through a regression of CHAL on academic success.
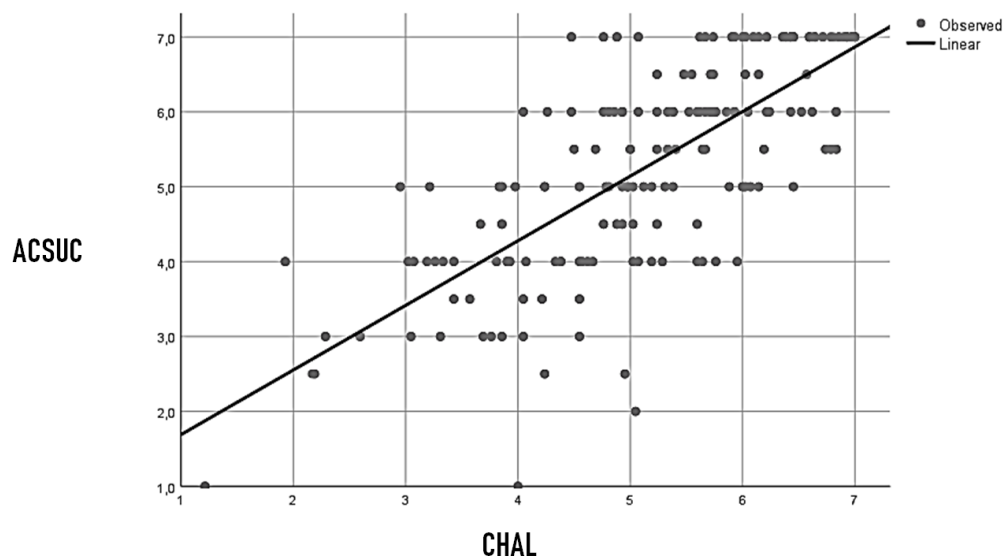
Table 9. Student challenges and self-reported EMI success

Model	Unstandardized Coefficients B	Standardized Coefficients Beta (β)	t	R^2	Adjusted R^2	F change
(Constant)	0.827		4.338			
CHAL	0.863	0.732	23.953***	0.536	0.535	573.767***

Dependent variable: ACSUC
***Significant at the 0.001 level

A significant relationship between all student challenges together and self-reported academic success was found [$F_{(1, 496)}= 573.767$, $p<0.001$), Adj. R^2 of 0.535] (see Table 9). An Adj. R^2 of 0.535 indicates that 53.5% of the variation in academic success was explained by student challenges. The scatterplot in Figure 2 also shows the strong positive linear relationship between student challenges and self-reported academic success in EMI. Thus, CHAL was considered as a significant predictor of academic success in EMI ($\beta= 0.732$, $p<0.001$). This result indicates that a lot of variance in success in EMI faced by students can be attributed to challenges that they encounter with academic English skills.

Figure 2. Scatterplot of student challenges and self-reported academic success in EMI

5 Discussion

The results of the study revealed that writing and speaking were found to be the most challenging areas of EMI study for students. Speaking in particular has been highlighted in previous studies as an area of difficulty for students in the Turkish EMI context (e.g. Kırkgöz 2005; Öner and Mede, 2015). More specifically, challenges related to academic English were salient in the participants' responses and included difficulties such as organising essays and using appropriate academic style in writing. Other difficulties reported by the students in this study related to participating in discussions and understanding their classmates. These results corroborate the findings of other studies examining EMI programmes in Turkey (e.g. Sert 2008; Yıldız, Soruç & Griffiths, 2017) as well as other contexts (e.g. Lee & Lee, 2018; Evans & Morrison, 2011; Hellekjær, 2010). The presence of similar results across contexts suggests that challenges related to speaking, academic writing, and vocabulary are a chronic problem in EMI contexts. Overall, these results suggest that students face challenges with productive skills and may benefit from

language courses with special attention given to academic skills and subject-specific terminology (Chang, 2010; Evans & Green, 2007; Jiang et al., 2019).

Students studying in the Social Sciences Faculty found writing and reading more challenging than engineering students. Such differences may stem from the expectations of subject-specific academic discourses (see Hyland 2004; 2006) and discipline-specific understandings of knowledge structures (Neumann, Parry, & Becher, 2002): the academic discourse of the natural sciences is 'vertical' with a systematic and hierarchical knowledge system; in contrast, the knowledge system of the social sciences is horizontal, requiring specialized languages to interpret texts (Kuteeva & Airey, 2014). The social sciences typically require more reading of abstract texts and more essay writing than engineering subjects, in which mathematical explanations may reduce the linguistic burden of writing and reading. Research examining STEM subjects taught through English in secondary schools (e.g. Lo and Macaro, 2012; Yip, 2004; Yip, Coyle & Tsang, 2007) has suggested that science teachers appear to explain abstract and complex scientific concepts in simple ways and refrain from using "higher-order questioning and conceptual change questions" (Pun and Macaro, 2019, p. 67). In contrast, social sciences teachers demand that students use their "higher cognitive skills such as analysis, synthesis and evaluation" (p. 67) in class discussions. At the university level, higher cognitive demands related to writing and reading for subjects taught in the social sciences may create more linguistic challenges for these students compared to engineering students. Such findings support previous EMI research in Europe, which has found that EMI policies need to be flexible enough to adapt to disciplinary differences (Airey et al., 2017).

In this study, first-year students perceived less reading-related challenges than second- and fourth-year students. One potential reason for this could be the increasing

complexity and difficulty of the EMI curriculum: as students advance in their studies, they enrol in classes which require more higher-order cognitive skills, which might lead to greater comprehension problems from students. Alternatively, students' language skills might not be improving as they progress in their undergraduate studies. Both explanations would challenge the effectiveness of EMI in terms of improving students' academic English skills (Jiang, Zhang & May, 2019). Further evidence is needed with respect to content and language learning as students progress in their EMI courses. Without qualitative data to supplement the results of this study, it is difficult to determine the reason behind differences reported by students according to discipline or year of study. Although questionnaire data allowed us to compare linguistic challenges between groups in a relatively large sample, questionnaires are limited in terms of providing nuance compared to rich qualitative data, and issues may arise with respect to participants' interpretation of items. Therefore, mixed-method approaches are needed to incorporate students' perspectives on the challenges they face throughout their EMI programmes.

Turkish students considered EMI courses more difficult than international students across skill areas, and students who met the proficiency requirements by passing the UNIP experienced more linguistic challenges than TOEFL- and IELTS-takers. Together, these results might suggest issues in terms of the quality and effectiveness of the English language curriculum in the university's EPP. In the context of this university, most international students are exempted from the university's EPP because they submit a satisfactory language proficiency exam score from TOEFL or IELTS. Most Turkish students, however, complete the EPP and pass the UNIP to meet the university's L2 proficiency requirements. The EPP system in Turkey has been criticised (e.g. Ekoç, 2018; Kırkgöz, 2009b) for not adequately addressing the language needs of students. The results of this study appear to

support claims that students continue to experience language-related challenges in EMI courses after completing the EPP, at least in comparison to students who meet the proficiency requirements without enrolling in the EPP.

Moreover, these findings raise concerns regarding the standards of the university's L2 proficiency exam to assess students' preparedness for EMI. The validity and reliability of the in-house exam may need to be reconsidered, particularly in comparison to international language tests, such as TOEFL and IELTS. The challenges experienced by UNIP-takers might suggest that the minimum passing score on the in-house exam was too low, or that the equivalency scores set by the university between the UNIP's minimum passing grade and the IELTS (5.5) and TOEFL (IBT 74) exams should be re-evaluated. Here, we are not suggesting that universities should eliminate in-house exams but rather that language specialists and university administrators should re-evaluate language assessment practices with respect to the needs of EMI students in their university contexts.

Moreover, in Turkey, EPP curricula often focus on the *level* of English rather than the *type* of English necessary in EMI courses. A similar focus on general English proficiency rather than EAP competencies has been reported in other country contexts as well (Galloway et al., 2017). The findings of this study suggest that students experienced challenges with respect to speaking and writing academic English. As such, the EPP curriculum as well as the L2 proficiency standards for EMI study should be revised to consider students' needs with respect to these skills. In particular, students enrolled to EMI programs would benefit from EAP courses that emphasis productive skills with a discipline-specific focus, rather than language courses aimed at general L2 proficiency. This echoes calls from previous research in other EMI contexts for greater levels of targeted language

support in EMI contexts where students language needs are greater (see Chang, Kim & Lee, 2017; Galloway & Ruegg, 2020; Aizawa & Rose, 2020).

Adding to this picture of linguistic preparedness for EMI programmes, students who studied academic subjects through EMI prior to university reported less linguistic difficulties than students who encountered EMI courses for the first time at university. This finding suggests that the transition from secondary school to university is more difficult for students experiencing a shift in MoI, and it offers evidence to support previous studies which have highlighted the challenges that students experience in the transition to EMI courses (Lin & Morrison, 2010; Evans & Morrison, 2011a, 2011b; Macaro et al., 2019). The findings also suggest that students transitioning to EMI from L1 MoI backgrounds may require additional linguistic support throughout their studies, which the EPP does not appear to provide. This study compared students who did and did not have previous experience studying through EMI; the questionnaire did not ask students how long they had studied through English. As such, in order to shed light on the challenges associated with transitioning to EMI programs, future research is needed to evaluate what effects, if any, the amount of previous EMI experience might have on students' experiences. Further research is also needed to determine how the linguistic challenges experiences by students transitioning to EMI affects their academic success in content classes.

6 Conclusion and implications

The research instrument developed by Evans and Morrison (2011) and used in this study was validated as a sound measure to examine the language challenges faced by EMI university students with respect to reading, writing, listening, and speaking. The validated

tool represents a valuable step in comparing students' experiences and their linguistic needs across EMI contexts. Additionally, the validated questionnaire has implications for university administrators and language specialists, who can utilize the instrument to assess the linguistic needs of students in their particular university context. Such knowledge can assist in the development of language support programs for students enrolled in EMI courses. The predictive qualities of the questionnaire could also be used as a diagnostic tool to assess the areas of academic English in which students experience the greatest challenges, thus helping to inform the EAP curriculum to best support their academic language development.

The findings from this study suggest that local, Turkish students in the Turkish EMI context are less adequately prepared for EMI courses than their international peers. This suggests that the English language learning curriculum of the EPP as well as the minimum passing threshold of the university proficiency exam need to be re-evaluated with respect to the linguistic demands of EMI. At Turkish universities, language support is offered through the EPP, a separate unit from the departments in which EMI content teaching occurs. More collaboration between language and content teachers may help to address the EAP needs of students (Dearden, Macaro, & Akincioglu, 2016; Jiang et al., 2019). In particular, such collaboration could improve the curriculum of the EPP and its proficiency exam by aligning the expectations of the EPP with students' language needs in EMI courses. Furthermore, limited language support is offered to students after completing the EPP, although these findings suggest that students may benefit from additional support throughout their studies.

Outside the Turkish context, these findings offer implications for HEIs and program administrators tasked with evaluating L2 proficiency criteria for EMI study, especially seeing as EMI research elsewhere has suggested that trends towards greater EMI provision are

often accompanied by HEIs not giving due consideration to questions of educational quality (Nguyen et at., 2016). These findings also might have greater relevance to wider debates on the efficacy of preparatory programs worldwide to prepare students for academic study. For example there is tension surrounding the alignment of university EAP outcomes with both local and international standards (Bruce & Hamp-Lyons, 2015), and it has been observed that many scholars and teachers question the effectiveness of EAP instruction on educational outcomes (Crosthwaite, 2016)

Given the EPP's critical role in implementing EMI in Turkey, the content of the EPP curriculum should be revised to address the writing- and speaking-related challenges faced by students. Furthermore, language support should be offered to EMI students throughout their studies in order to ensure that they are developing the language skills needed to meet the cognitive demands of increasingly difficult academic content (Chang, Kim, and Lee, 2017). Based on these findings of this study, language support systems, including the EPP, could be revised to consider differences in students' needs with respect to academic discipline. Rather than a one-size-fits-all approach to language support, curricula could be redesigned to incorporate more discipline-specific instruction in the form of EAP and ESP classes tailored to students' needs.

While writing and speaking were found to be the areas in which students experienced the greatest challenges in their EMI courses, this study does not compare student challenges with respect to a direct measure of L2 proficiency. Differences in the exams taken to meet the university's L2 proficiency requirements prevent us from drawing direct comparisons with respect to students' L2 proficiency. In other words, we cannot directly compare the proficiency levels of students who took the UNIP with students who submitted IELTS or TOEFL scores, because a precise conversion between the in-house and

external exams is unknown. Future research is needed to investigate the relationship between L2 proficiency and language-related challenges in EMI.

Moreover, this study examined academic success using self-reported measures, which are inherently more subjective than direct measures such as GPA or exam scores. Additional research using direct measures is needed to investigate the relationship between language challenges and academic success in EMI programs. Finally, because data for this study were collected from one university in Turkey, the generalizability of its findings is limited. More research is needed to explore how the language-challenges reported here compare to other university contexts.

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Appendix

Table 9: International students' backgrounds

International Students' L1 Background (n = 162)	Languages	Frequency
Students who reported one language as L1 *(n1 = 123)*	Arabic Russian German Sesotho Farsi Azerbaijani French Kurdish Greek Uzbek Urdu Armenian Romanian Southern Sesotho	47 16 13 8 8 7 6 5 3 3 2 2 2 1
Students who reported two languages as L1 *(n2 = 32)*	Arabic and French Arabic and English Uzbek and Arabic Russian and English Ruutoro and English Urdu and English	9 8 6 4 3 2
Students who reported three languages as L1 *(n3 = 7)*	Arabic, Farsi and English Russian, Azerbaijani and English Uzbek, Arabic and Russian	3 2 2
		Total =162

Table 10: Items of the questionnaire, constructs and factor loadings

Items	F1: Writing Challenges (α= 0.963)	F2: Speaking Challenges (α= 0.962)	F3: Listening Challenges (α= 0.954)	F4: Reading Challenges (α= 0.957)
CW12. Writing the introduction to an assignment	0.806			
CW13. Writing the body of an assignment	0.798			
CW14. Writing the conclusion to an assignment	0.797			
CW15. Linking sentences smoothly	0.736			
CW5. Writing a bibliography/references section	0.699			
CW4. Using appropriate academic style	0.684			

Item	Factor 1	Factor 2	Factor 3	Factor 4
CW9. Organising ideas in coherent paragraphs	0.679			
CW1. Planning written assignments	0.672			
CW8. Summarising/paraphrasing ideas in sources	0.665			
CW10. Expressing ideas clearly and logically	0.652			
CW11. Linking ideas from different sources	0.649			
CW3. Revising written work	0.608			
CW7. Referring to sources in written work	0.584			
CW6. Proofreading written work	0.572			
CW2. Expressing ideas in correct English	0.319**			
CS5. Communicating ideas fluently		0.802		
CS4. Participating actively in discussion		0.792		
CS9. Communicating ideas confidently		0.755		
CS7. Asking questions.		0.734		
CS8. Answering questions		0.721		
CS3. Presenting information/ideas.		0.714		
CS6. Speaking from notes		0.706		
CS1. Speaking accurately (grammar)		0.699		
CS2. Speaking clearly (pronunciation)		0.683		
CS10. Using visual aids (e.g. PowerPoint)		0.659		
CL4. Taking brief, clear notes			0.783	
CL1. Understanding the main ideas of lectures			0.775	
CL2. Understanding overall organisation of lectures			0.751	
CL3. Understanding key vocabulary			0.736	
CL8. Identifying different views and ideas			0.706	
CL5. Identifying supporting ideas and examples			0.702	
CL9. Understanding questions			0.651	
CL7. Following a discussion			0.622	
CL6. Understanding lecturers' accents			0.592	
CL10. Understanding classmates' accents			0.503	
CR6. Reading quickly to get overall meaning				0.723
CR4. Reading quickly to find specific information				0.703
CR3. Reading carefully to understand a text				0.677
CR7. Identifying the key ideas of a text				0.638
CR1. Understanding specific vocabulary				0.601
CR5. Identifying supporting ideas and examples				0.589
CR2. Working out the meaning of difficult words				0.571
CR10. Understanding the organisation of a text				0.568
CR8. Taking brief, relevant notes				0.552
CR9. Using your own words when taking notes				0.386**

**Dropped items

Kaiser-Meyer-Olkin Sampling Adequacy	0.983
Barttlet's Test of Approx. Chi-Square Sphercity	29503.728**
Overall reliability of the scale (α= 0.974)	*

***P< 0.001