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A longitudinal study at an English Medium Instruction university in Turkey: the interplay between English language improvement and academic success.

Abstract

This article reports a quantitative empirical study that investigated whether English language proficiency increases over time when studying academic content through English Medium Instruction (EMI). It was also investigated whether an increase in proficiency predicts EMI academic achievement. Student English language test score data and Grade Point Average (GPA) data were collected from a public university in Turkey. Two academic subjects were compared: Business Administration (a Social Science subject, n=81) and Mechatronics Engineering (a Mathematics, Physical and Life Sciences subject, n=84). Results showed a statistically significant improvement in the English proficiency levels of both subjects over a four-year period of studying through English. Furthermore, this improvement predicted EMI academic achievement; meaning that the more proficient students became in English, the higher they achieved in their EMI academic studies. This provides evidence for policymakers, EMI practitioners, and language professionals around the world that English does improve when studying academic content through English, and that this improvement has a positive effect on content learning outcomes. Implications of these findings, and suggestions for further research are discussed.

Keywords: English medium instruction (EMI); General English Proficiency (GEP); Turkey; Academic Success; Higher Education (HE)

Introduction

English as a medium of instruction (EMI) is defined here 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, p. 19). In EMI higher education (HE) lecture halls, therefore, the focus is on content acquisition rather than language acquisition. However, numerous higher education institutions (HEIs) across the globe have implemented EMI with an innate assumption that students' English language

proficiency will improve over time due to the use of this medium of instruction (MOI, Galloway, Numajiri & Rees, 2020).

Research into the use of EMI in higher education (HE) has witnessed unprecedented growth over the past decade (Macaro et al, 2018; Curle et al, 2020b). Numerous studies have investigated lecturers' and students' attitudes towards this MOI (e.g., Dearden & Macaro, 2016; Kuteeva & Airey, 2014; Roothooft, 2019), the impact of MOI on learning outcomes (e.g., Dafouz, Camacho & Urquia, 2014; Dafouz & Camacho-Miñano, 2016; Klaassen, 2001) and the challenges these stakeholders face when implementing EMI (Pun & Thomas, 2020; Soruç & Griffiths, 2018). Recently scholars have shown a growing interest in the student learning outcomes of EMI programmes (e.g., Ament & Pérez-Vidal, 2015; Dafouz, Camacho & Urquia, 2014; Dafouz & Camacho-Miñano, 2016; Li, 2018; Rose, Curle, Aizawa, & Thompson, 2019; Terraschke & Wahid, 2011; Xie & Curle, 2020). However, few studies have longitudinally tracked the English language development of students studying through EMI to ascertain evidence of improvement. Additionally, no study has then taken this analysis a step further to explore whether an improvement in English language proficiency facilitates students' EMI academic success. Finally, few studies have explored whether an improvement in language proficiency and facilitation of EMI academic success varies according to academic subject. This study aims to fill these gaps in the EMI literature with its four-year longitudinal research design, shedding further light on the development of English language proficiency when studying through EMI, and its impact on EMI academic success.

EMI in Turkey

The use of English to teach in higher education in Turkey is not new. It dates back more than six decades to 1956 when the Middle East Technical University was established using EMI, in Ankara (the capital of Turkey). Scholars have described the use of EMI in Turkish HE as a 'danger' (Ünlü, 2009), a 'delusion' (Köksal, 2002), or even 'destruction' (Karabulut, 2001). In 2015, the British Council Turkish higher education report (West, Guven, Parry, & Ergenekon, 2015, see page 118) laid out clear negative implications of adopting EMI. Despite this overall pessimistic view, the number of EMI undergraduate programmes in Turkey has still proliferated over the years. One hundred and ninety-three Turkish universities offer 10,396 undergraduate programmes, of which 2,542 programmes are advertised as 'full EMI' with 378 'partial EMI'. This accounts for 28% of all programmes in

Turkish universities. Dearden and Macaro (2016) note that one of the main drivers behind the unprecedented growth of EMI is to attract international students and staff, hence internationalising universities. Uçar and Soruç (2018) investigated students' choice to study through EMI. Students reported instrumental factors such as getting a good job after graduating. Macaro and Akıncıoğlu (2018) reported similar findings; students' choice was dictated by the underlying assumption that if they studied through EMI, their English would improve. This they stated would then in turn improve their social standing and career prospects. Other studies on EMI in Turkey have examined: type of student motivation (Kırkgöz, 2005; Turhan & Kırkgöz, 2018), the use of the mother tongue in EMI classes (Kılıçkaya, 2006), overall perceptions of EMI students (Kırkgöz, 2013, 2014), student challenges (Soruç & Griffiths, 2018), beliefs about the effectiveness of EMI programmes (Sert, 2008), and lecturer expectations of EMI (Inan, Yuksel, & Gurkan, 2012). To date, however, no studies have been conducted in Turkey to investigate whether English language proficiency improves after taking EMI courses for an extended period of time. This study aims to fill this gap in the literature.

English Language Proficiency and EMI

The issue of whether English language proficiency improves after a certain period of taking EMI courses has been raised in the literature as a central and rather controversial topic (Dearden, 2018; Dearden & Macaro, 2016; Macaro, 2015, 2018; Tsou & Kao, 2017). Exposure to English in EMI classrooms is inevitable, and therefore, it might be assumed that students, one way or another, improve their English language proficiency. This language issue was raised as one of the seven key controversies in Dearden's (2015) survey of nearly 400 EMI teachers from 55 countries. 80% of the teachers expressed agreement with the statement "Does EMI improve English proficiency?". Although an improvement in English language proficiency is not included as a component in Macaro's (2018) definition of EMI, Doiz and Lasagabaster (2020) argue that "one of the objectives of EMI programmes is aimed at improving students' foreign language competence while learning content delivered in English" (p. 258).

Empirical studies related to whether English language proficiency improves or not when studying through EMI can be grouped into two categories: students'/lecturers' *perceptions* about the potential improvement in English language proficiency, and pre-/post-test design

studies that have measured *actual* language development. These two strands of research will now be investigated in this current research.

Perceptions of English language development in EMI

The first strand of research into EMI and language development has focused on perceptions. Lecturers' perceptions of students' English language development when studying through EMI have been investigated in different contexts around the globe. Belhiah and Elhami (2015) surveyed 100 lecturers across a range of institutions in the United Arab Emirates (UAE) to determine what impact lecturers believed EMI was having on students' English language proficiency. Findings showed lecturers were positive that EMI improved students' English proficiency. Similarly, Byun et al. (2011) explored this in the Korean EMI HE setting, and also found positive views about English language development. In their investigation of three countries in Europe, Dearden and Macaro (2016) also found that most university lecturers thought that teaching through EMI would improve the students' English. Recently, Briggs, Dearden and Macaro (2018) surveyed the perceptions of 167 participants from 27 countries in secondary and tertiary institutions. Again, findings showed that lecturers believed that simply by teaching academic content through English, their students' English would improve. This body of research reveals that university lecturers often believe that EMI leads to the improvement of students' English language proficiency. However, as Macaro (2015, p. 6) argues, this improvement might be "a bi-product rather than an actual goal" of EMI.

Measuring the impact of EMI on English language development

The second strand of research examining the impact of EMI on English language proficiency have been studies measuring actual language development over time. These few studies have adopted a pre-/post-test research design, measuring English language proficiency at one point in time when studying through EMI, and again after a period of time (Ross, 1998). These studies are summarised in Table 1.

Table 1. Previous studies that focused on the impact of EMI on language development

Author, Year	**Context & Participants**	**Academic Subject**	**Language Tests Used**	**Years of EMI study**
Lei and Hu (2014)	64 Chinese undergraduate EMI students	Business Administration	National Standardized English Proficiency	1 (out of 4)

			Test	
Yang (2015)	29 Taiwanese EMI students	International Tourism	Locally- developed General English Proficiency Test	2
Rogier (2012)	59 undergraduate students from UAE	Five colleges including Arts and Sciences, Business, Communication and Media, Education and IT	IELTS	4
Ament and Pérez-Vidal (2015)	16 undergraduate students from Spain	Economics	an oral comprehension test; a written composition; a cloze task; a grammar task	1

Lei and Hu (2014) examined whether EMI has an impact on 64 Chinese Business Administration undergraduate students' English proficiency, as measured on a national standardised English proficiency test. Results revealed no evidence of the benefit of studying through EMI and English language improvement. Lei and Hu, however, limited the focus of this study to the effects of *one* year of EMI study. This limited time frame may have hindered the potential for significant results. In another study that explored how much linguistic gain can be expected after one year of EMI studies, Ament and Pérez-Vidal (2015) examined the impact of full and partial (50%) EMI conditions in the Spanish setting in an Economics programme. Linguistic gain was measured via four tasks namely an oral comprehension test, a written composition, a cloze task, and a grammar task. Results of Ament and Pérez-Vidal revealed that significant gains were found only in the partial EMI group and only for the grammar task. However, the number of participants in the full and partial EMI groups was only seven and nine, respectively, which might have hindered the generalisation of the findings.

In another study, Yang (2015) attained similar results in the context of Taiwan. In this study, 29 Taiwanese undergraduate students' English proficiency levels were measured through a pre-test before they started an international tourism EMI programme. The test was a

simulated General English Proficiency (GEP) test, sponsored by the Taiwanese Ministry of Education to assess the general English proficiency of EFL learners. The students took the same kind of test after two years of EMI study as a post-test and the scores from both tests were compared. Findings showed no statistically significant difference between the pre and post-test scores of individual students' English language proficiency. This means those who achieved higher in the pre-test still performed better than others in the post-test, and low achievers showed little development between pre- and post-tests.

In contrast to these two studies, Rogier (2012) reported a statistically significant improvement in International English Language Testing System (IELTS) scores of 59 undergraduate students studying through EMI in the United Arab Emirates. Comparing measurements (pre-/post-tests) for each language skill (listening, reading, writing, and speaking), results showed that after four years of EMI study, students' overall IELTS band score increased (particularly in speaking and reading). However, there are two important limitations to this study. First, the study was conducted with an all-female sample. Previous research has often found female students to be more motivated to learn languages and achieve greater success in language learning than males (Bacon, 1992; Sunderland, 2000; Lasagabaster, 2016). This therefore may have skewed the results. Second, participants were studying varied academic subjects; from arts subjects, to science subjects, to education. This casts doubt on the comparability of these IELTS scores as it may be argued that different academic disciplines rely on language to different extents (Curle, 2018). This may result in a large discrepancy in the exposure students get to English in each academic discipline, which in turn could have affected each students' degree of English improvement.

Limitations of these pre-/post-test designed studies that investigated students' language development after studying through EMI may be summarised as follows:

- Each study had a somewhat small sample size (n range: 29 to 64)
- Academic discipline-based comparisons were not conducted
- Except for Rogier (2012), language proficiency after participants had fully completed their EMI studies was not measured

The current study attempts to address these gaps in the literature. Pre-/post-test English language proficiency data was collected in a European context (Turkey) from a relatively larger sample of students (n=165), especially when compared to the previous research at the

start and the end of their EMI studies (four years). This study therefore makes an original contribution to knowledge by filling these multiple gaps in the EMI literature.

English language proficiency and Academic Success

Various studies have explored the relationship between English language proficiency and academic success. In non-EMI contexts, studies have found a statistically significant relationship between academic success and English language proficiency (Cho & Bridgeman, 2012; Ghenghesh, 2014; Neumann et al., 2019; Yen & Kuzma, 2009). In a meta-analysis of studies investigating the relationship between English proficiency and academic achievement (Grade Point Average (GPA) scores) of international students in the United States, Wongtrirat (2010) found proficiency to be a significant predictor of academic success. Some studies, however, have found contradictory results where language proficiency did not predict academic achievement in a statistically significant level (Gajewsky, 2019; Greene, 2007; Van Nelson et al., 2004).

Factors predicting academic success have also been explored in EMI contexts. These factors have included; academic self-concept (Neumann et al., 2019), language learning motivation (Rose et al., 2019), and academic success in the first (language) medium of instruction (Curle et al., 2020a; Altay et al., under review). The most prominent predictor, however, has been English language proficiency. This has included general English proficiency (Altay et al., under review; Curle et al., 2020a; Neumann et al., 2019; Wait & Grassel, 2010), as well as academic English proficiency (i.e. English for Academic Purposes (EAP), Terraschke & Wahid, 2011; Xie & Curle, 2020). Rose et al. (2019) investigated the role of general English language proficiency as well as EAP in predicting EMI academic success. Using the business administration content scores from 146 Japanese students, it was found that both general English language proficiency *and* EAP were statistically significant predictors of success in EMI. Contrastingly, Curle et al. (2020a) examined the EMI academic success of 159 Turkish Economics students and found that general English proficiency was *not* a statistically significant predictor of EMI academic achievement. Neither of these studies, however, took possible academic discipline differences into account. Altay et al. (under review) investigated the relationship between general English language proficiency and EMI academic success in different disciplines. 357 participants from the Mathematical, Physical, and Life Sciences (MPLS) division of a Turkish public university were sampled, alongside 359 participants from the Social Sciences division. Results revealed that general English language proficiency was a strong predictor of academic achievement in Social

Science subjects, however *not* in MPLS subjects. This was argued to be due to the heavy reliance on flexible and creative language use (Kuteeva & Airey; 2014) of Social Sciences involving more interactive and small group seminars (Bolton & Kuteeva, 2012) and more verbal resources and memorisation (Dafouz, Camacho & Urquía, 2014). Notwithstanding that, it was also concluded (ibid) that MPLS students rely more on their L1; not only in terms of Knowledge Transfer, but also, throughout their daily EMI learning experience.

None of the reviewed studies here that investigated the relationship between English language proficiency and EMI academic success examined whether *gains* in English language proficiency play a role in EMI academic achievement. This study aims to fill this gap in the literature by unpacking whether improved general English language proficiency influences EMI academic achievement, comparing a Social Science and an MPLS subject.

Design of the study

This study seeks to address the following research questions:

1a. Does students' English language proficiency increase after four years of studying through English Medium Instruction in Social Science and MPLS academic subjects?

1b. Does an improvement in English language proficiency predict student EMI academic success in a subject from the Social Sciences and a subject from the MPLS?

Context

Higher education institutions in Turkey adopt two distinctive types of EMI programmes: *partial* and *full* (Soruç et al., 2018). The data of this study came from a partial EMI programme, categorised by Macaro (2018) as a 'Multilingual Model': a hybrid rather than an 'English only' use of language. Students are required to take at least two EMI courses per semester alongside their other courses taught through their first language (L1), Turkish. Data was collected at a major public university which has 13 EMI programmes in two main academic divisions (i.e., Social Sciences and MPLS). One academic subject was chosen from each division (Business Administration from the Social Sciences and Mechatronics Engineering from MPLS) in order to minimise the effects of context-related confounding variables (Margić & Vodopija-Krstanovic, 2016).

Participants

After obtaining the necessary legal and ethical permissions from the university to conduct this study, students' informed written consent was obtained. 81 students from Business

Administration and 84 from Mechatronics Engineering permitted their data to be used in this study. Further details about the participants include:

- all students had completed four academic years of EMI study
- all students had completed a minimum of 20 EMI courses and 40 Turkish Medium Instruction (TMI) courses
- all students had taken at least two semesters of compulsory General English Proficiency preparatory education before starting their EMI studies. Preparatory education was compulsory for all the students whose data were used in this study. This prep education aimed at teaching general English in four language skills using communicative approach according to the website of the university.

Data Collection

Data in this study came from a variety of sources. First, a General English language proficiency test was given to the same group of participants at two different times. These measurements could be labelled 'pre-' and 'post-' test. The pre-test was conducted at the beginning of the fall semester in 2016. This was after students had completed their preparatory programme, before starting their EMI studies. The post-test was given after four years of EMI study, in the fall semester of 2020. The test used was an institutionally adapted version of the Cambridge Preliminary English Test (PET) at a B1 level of difficulty (Cambridge ESOL, 2014). this test was expected to gauge the students' proficiency level at the entrance before their major of study (e.g., B1 level), while there were also students who performed better than this level (e.g., B2 level) when they took the test after four years of EMI study. This test measured students' language skills, namely Reading, Writing, Listening, and Speaking. Finally, student exam scores were obtained from the University Registrar's Office. These scores served as a measure of academic success in the EMI subject studied.

Test-Retest Design

A common approach to measuring language improvement is to compare the difference (if any) of two time points of measurement on a standardized proficiency test (in this study, the Cambridge PET). This provides a comparable, standardised assessment at each time point (Ross, 1998). This test/retest method (O'Loughlin & Arkoudis, 2009; Storch & Hill, 2008) was used in this study to determine whether there were any language gains after four years of

EMI study. Therefore, given the relatively long-time interval from pre- to post-test (four years in our case), we did use the same PET version to retest the students' language proficiency. In terms of the validity and reliability of PET, studies and research reports published in Studies in Language Testing (SILT) series offer detailed information. More specifically, validity of the writing section of the PET was explored in Shaw and Weir (2007), reading section in Khalifa and Weir (2009), speaking section in Taylor (2011) and listening section in Geranpayeh and Taylor (2013).

Data analysis

Using the computing software R, we first performed paired-sample t-tests to compare English language proficiency at Time 1 (Year 1) and English language proficiency at Time 2 (Year 4), for each academic subject (Social Sciences and MPLS; RQ1a). The data met all assumptions for paired sample t-tests: data were normally distributed, no outliers were detected, and the assumption of homogeneity was met (Levene's F tests were all non-significant ($p > 0.05$)). As the t-tests only tested whether there was a statistically significant difference in English language proficiency between Time 1 and Time 2, the analysis was taken a step further to explore whether an increase in English proficiency predicted EMI academic achievement (RQ1b). Simple linear regression was run for each academic subject (Social Sciences and MPLS). For this analysis, a purposive sampling procedure was adopted so as to only include participants whose English proficiency *increased* over the four-year period (see McKinley & Rose, 2020). 15% of the Business Administration sample and 27% of the Mechatronics Engineering sample were therefore excluded from this analysis. Furthermore, those whose proficiency neither increased nor decreased (Business Administration: 4%; Mechatronics Engineering: 2%) were also excluded. This sampling procedure is summarised in Table 2.

Table 2. Summary of Purposive Sampling procedure for Simple Linear Regression

Business Administration (Social Science)	**English Proficiency Characteristic**	**Number of participants**
	No increase or decrease in English language proficiency	n=3 (4%)
	English language proficiency decreased	n=12 (15%)

	Original sample size	n=81
	Simple Linear Regression sample size	n=66
Mechatronics Engineering (MPLS)	**Proficiency Characteristic**	**Number of participants**
	No increase or decrease in English language proficiency	n=1 (2%)
	English language proficiency decreased	n=23 (27%)
	Original sample size	n=84
	Simple Linear Regression sample size	n=60

Results

Does students' English language proficiency increase after four years of studying through English Medium Instruction in Social Science and MPLS academic subjects?

To answer RQ1a, paired sample t-tests were used to compare English language proficiency scores at Time 1 (Year 1) with scores at Time 2 (Year 4), for each academic subject (Social Sciences and MPLS). Descriptive statistics in Table 3 show that both subjects had a similar range (between 20 and 30) at each time point. Similarly, the Standard Deviations across years and subjects were similar (ranging from 5 to 5.59). Skewness and Kurtosis values were within an acceptable range (Hair, Black, Babin, Anderson, & Tatham, 2010); Social Sciences ranged from 0.66 to -0.60, Mechatronics Engineering ranged from 0.24 to -0.76. Data was therefore accepted as approximately normally distributed.

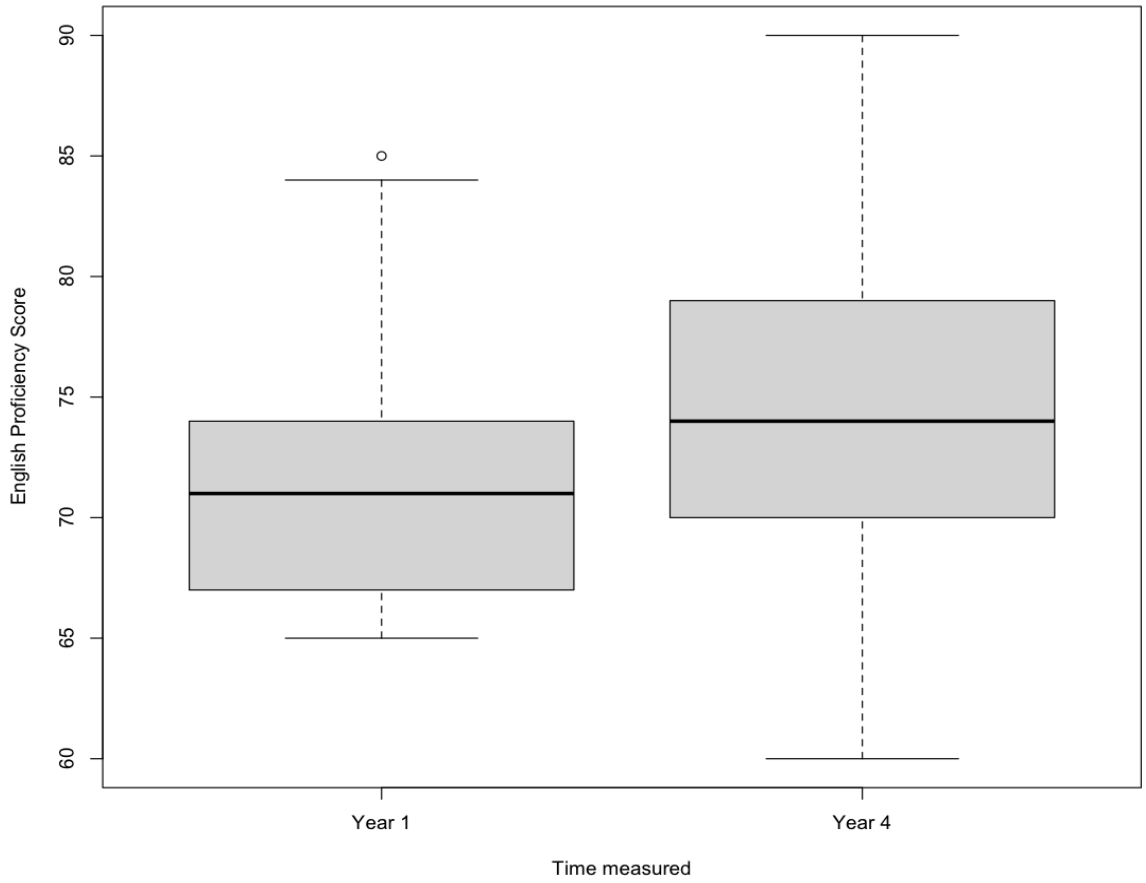
Table 3. Descriptive statistics of English Proficiency in Year 1 and Year 4

Variable	*N*	Mean	SD	Median	Min	Max	Range	Skew	Kurtosis
Business Administration: Year 1 English proficiency	81	71.14	5.05	71	65	85	20	0.66	-0.31
Business Administration: Year 4 English proficiency	81	74.75	5.10	74	60	90	30	0.23	-0.60
Mechatronics Engineering: Year 1 English proficiency	60	73.74	5.60	73.5	65	88	23	0.26	-0.76
Mechatronics Engineering: Year 4 English proficiency	60	75.90	5.59	76	63	92	29	0.24	-0.35

Business Administration

Business Administration (Social Science) data showed that there was a statistically significant increase in English language proficiency scores after four years of EMI study (Year 4: M=74.75, SD=6.56), compared to scores at the start of EMI study (Year 1: M=71.14, SD=5.05), t(80)=7.8, p=0.000***. These results suggest that studying Business Administration through English does increase students' English language proficiency over time. Figure 1 visually represents this increase.

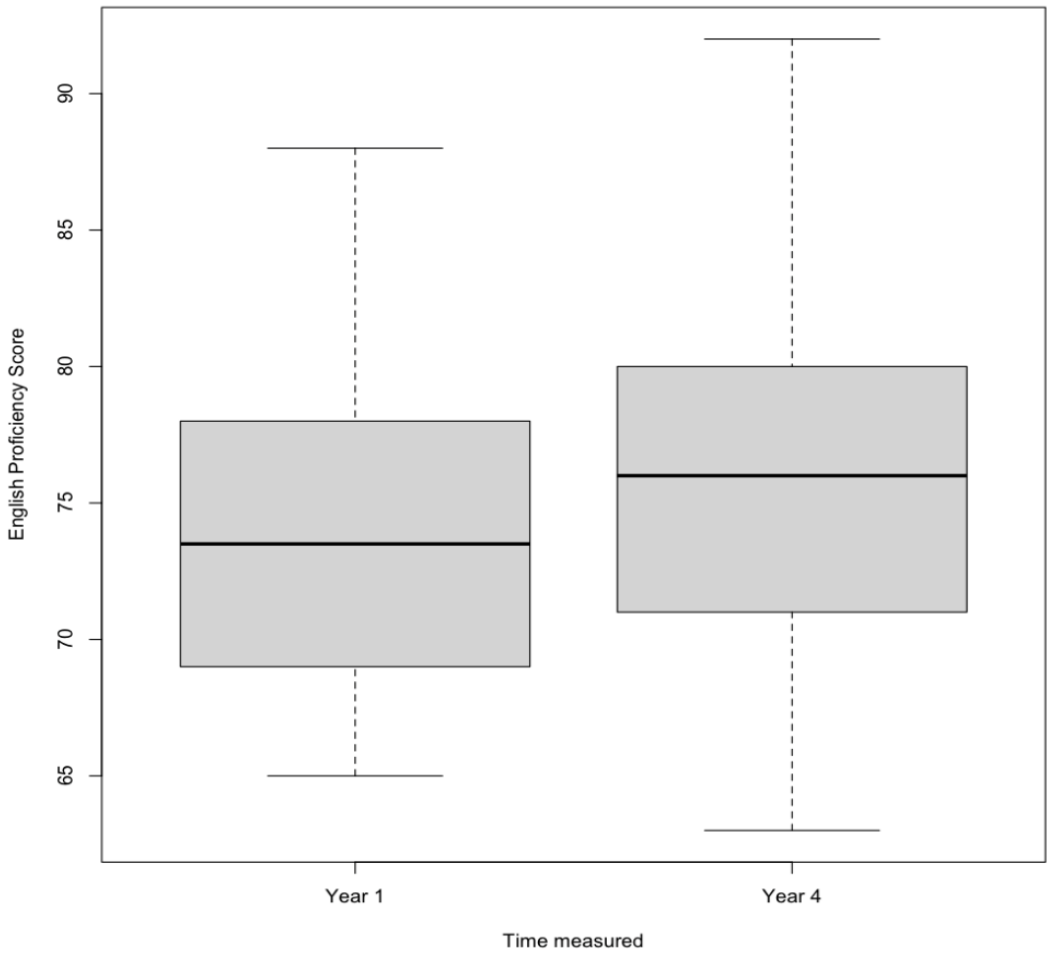
Figure 1. Increase in Business Administration English language proficiency scores over time



Mechatronics Engineering

Mechatronics Engineering (MPLS) data showed that there was a statistically significant increase in English language proficiency scores after four years of EMI study (Year 4: M=75.9, SD=5.59), compared to scores at the start of EMI study (Year 1: M=73.74, SD=5.6), t(83)=4.77, p=0.000***. Again, these results suggest that studying Mechatronics Engineering through English does increase students' English language proficiency over time. Figure 2 visually represents this increase.

Figure 2. Increase in Mechatronics Engineering English language proficiency scores over time



Does an improvement in English language proficiency predict student academic success in a Social Science and an MPLS English Medium Instruction academic subject?

To answer RQ1b, simple linear regression was used to determine whether an improvement in English language proficiency predicted academic success in a Social Science and an MPLS academic subject (hypothesising that; the more improvement in English proficiency, the more successful students are in their EMI studies). Descriptive statistics in Table 4 show that both subjects shared a similar range in English proficiency improvement (Social Science=10, MPLS=14) as well as in academic success scores (Social Science=31, MPLS=39). Similarly, the Standard Deviations were comparable (Improvement: Social Science SD=2.63, MPLS SD=2.68; Success: Social Science SD=7.31, MPLS SD=8.27). Skewness and Kurtosis values

were within an acceptable range (Hair, Black, Babin, Anderson, & Tatham, 2010); data was therefore accepted as approximately normally distributed. The data met all assumptions for linear regression (see Tabachnick & Fidell, 2013): there was a linear relationship between variables (no outliers were detected), data was approximately normally distributed, and homoscedasticity was not present (Bartlett's Test of Sphericity reached statistical significance (X^2 (350) = 524.90, $p < 0.001$).

Table 4. Descriptive statistics of all Simple Linear Regression variables

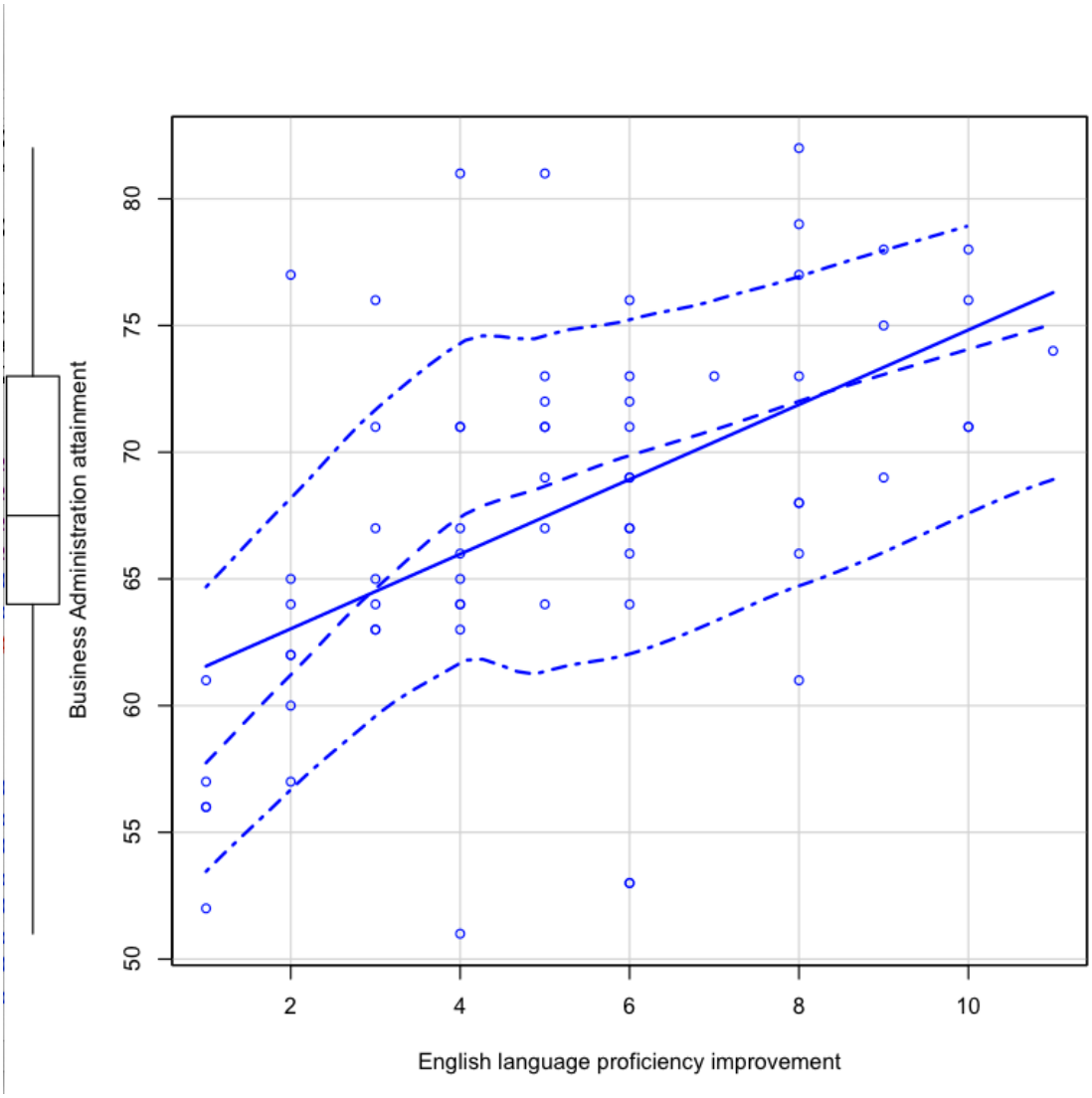
Variable	***N***	**Mean**	**SD**	**Median**	**Min**	**Max**	**Range**	**Skew**	**Kurtosis**
Business Administration: Improvement in English proficiency	66	5.17	2.63	5	1	11	10	0.28	-0.83
Business Administration: EMI academic success score	66	67.7	7.31	67.5	51	82	31	-0.25	-0.40
Mechatronics Engineering: Improvement in English proficiency	60	4.25	2.68	4	1	15	14	1.46	2.83
Mechatronics Engineering: EMI academic success score	60	63.18	8.27	63	49	88	39	0.55	-0.16

Business Administration

First, the Business Administration (Social Science) data was explored. The scatterplot in Figure 3 indicates a positive correlation between English language improvement and

Business Administration success. This correlation was statistically significant (r =0.531, p = 0.000***), meaning the more students' English language proficiency improved, the higher their Business Administration EMI content scores.

Figure 3. Scatterplot of English language improvement and Business Administration academic success



Simple linear regression showed a statistically significant relationship between participants' improvement in English proficiency and their EMI academic achievement scores (F(1,64)=25.23, p=0.000***). Table 5 shows that students' EMI course scores increased by 1.47 for every one-point increase in English proficiency. The R^2 showed that an improvement

in English proficiency explained 27.16% of the variance in Business Administration EMI course scores. The standardised Beta (β=0.531) confirmed these findings; EMI content scores increased by 0.531 standard deviations for every one standard deviation increase in English proficiency improvement (SD=2.63). Improvement in English proficiency therefore statistically significantly predicted success in EMI Business Administration courses.

Table 5. Linear regression output: Improvement in English proficiency and EMI Business Administration success

	ΔR²	***B***	***Standardised β***	***R***	***t value***	***p value***
Constant	0.2716	60.07			35.339	<0.000***
Improvement in English proficiency		1.47	0.531	0.28	5.023	0.000***

<u>Mechatronics Engineering</u>

Next, the Mechatronics Engineering (MPLS) data was explored. There was a positive correlation between English language improvement and Mechatronics Engineering success, meaning the more students' English language proficiency improved, the higher their Mechatronics Engineering EMI content scores. However, this correlation was *not* statistically significant (r =0.054, p=0.68). Further exploration using a simple linear regression also revealed a non-statistically significant relationship between participants' improvement in English proficiency and their EMI Mechatronics Engineering academic achievement scores (F(1,58)=0.172, p=0.67). Table 6 shows that students' EMI course scores increased by 0.168 for every one-point increase in English proficiency. The R^2 showed that an improvement in English proficiency explained 1.4% of the variance in EMI course scores. The standardised Beta (β=0.054) confirmed these findings; EMI content scores increased by 0.054 standard deviations for every one standard deviation increase in English proficiency improvement (SD=2.68). Improvement in English proficiency therefore did *not* statistically significantly predict success in EMI Mechatronics Engineering courses.

Table 6. Linear regression output: Improvement in English proficiency and EMI Mechatronics Engineering success

	ΔR^2	*B*	*Standardised β*	*R*	*t value*	*p value*
Constant	-0.014	62.46			30.790	<0.000***
Improvement in English proficiency		0.168	0.054	0.002	0.416	0.67

Discussion, Limitations, and Future Research

This study investigated whether students' English language proficiency increases after four years of studying through EMI in a Social Science and an MPLS academic subject. It then examined whether this improvement in proficiency predicts academic success in these different disciplines.

English language proficiency improves after studying through EMI

Students' general English language proficiency was found to improve significantly after four years of EMI study. Put another way, the students who failed to receive an English language proficiency score at B1 level (and therefore had to spend a year in the preparatory school) did significantly increase their English proficiency level after four years of exposure to EMI. This held true in both a Social Science (Business Administration) and an MPLS (Mechatronics Engineering) academic discipline. These results provide empirical evidence to support EMI lecturers' (Belhiah and Elhami, 2015; Dearden and Macaro, 2018) and learners' (Macaro and Akıncıoğlu, 2018) perceptions that students' English language proficiency improves when studying academic content through English. Further research is needed, however, to investigate stakeholders' perceptions of the effects that this language improvement might have. For example, it is unknown whether this improvement in English proficiency leads to: students getting 'better' jobs after graduating from EMI programmes (Uçar and Soruç, 2018), whether that in turn improves students' career prospects (Huang & Curle, in press), and therefore their 'social standing' (Macaro and Akıncıoğlu, 2018). Conducting longitudinal studies tracking students after graduating from EMI programmes (as

they progress through their careers) would provide vital evidence of these perceived benefits that improved English proficiency might bring.

The finding that English language proficiency improves after four years of studying through EMI is in contradiction to studies done by Lei and Hu (2014) and Yang (2015), who found no evidence of English improvement. These studies, however, measured language proficiency after only one and two years of EMI education respectively. This highlights the possibility that the effects of EMI on language improvement may not become evident until after two years of EMI education. Further research is therefore called for. One limitation of the current study was the limited measurement of linguistic development (i.e., the start of EMI studies compared to the end of EMI studies after a four-year period). Future research might consider measuring student language development at different times intervals throughout EMI education (for example: after 1 month, 3 months, 6 months, 9 months, 1 year, 2 years etc). This would provide a detailed record to better understand students' language development while studying through EMI.

Finally, finding a statistically significant improvement of English language proficiency after four years of EMI study in Turkey is similar to results as found by Rogier (2012) in the United Arab Emirates. This may be due to the same timeframe of measurement (i.e., after a four-year period of EMI study), again illustrating this as possibly a key factor to seeing any linguistic gains when studying through EMI. Our results were also consistent with those of Ament and Pérez-Vidal (2015), a one-year study, which reported linguistic gain in the grammar domain for partial EMI students in the Economics programme. In our study, unlike Rogier (2012) and Ament and Pérez-Vidal (2015), however, we did not measure students' different language skills (i.e., reading, writing, listening, and speaking). This would have provided further insight into exactly which skills improved, and by how much. It is therefore recommended that future research take such detailed linguistic measurement into consideration. This would provide EMI lecturers with a clearer idea of exactly in which language areas students need additional linguistic support that English as a Foreign Language (EFL) or EAP teachers might provide.

English language improvement predicts EMI academic success

The findings related to the relationship between an improvement in English language proficiency and EMI academic success were slightly more complex. An improvement in English proficiency statistically significantly predicted success in EMI Business Administration courses but *not* in Mechatronics Engineering courses. This finding illustrates that EMI might not 'kill two birds with one stone' (Hu & Lei, 2013:552); that is, increase English language proficiency does not always mean increase academic content knowledge, particularly in an MPLS subject as in our research reported in this paper. Therefore, this finding should be considered carefully since language proficiency is not an overt objective of these EMI programmes and there can be other factors. However this has implications for pedagogy as MPLS lecturers now know that as students' progress through their EMI programmes, an improvement in English proficiency may not be a key determining factor of students' academic success. Further research is needed to discover what other factors may be influencing EMI MPLS student achievement.

Related to the disciplinary differences, further evidence comes from Sawir's (2011) study conducted with academic staff (n=80) from four faculties: faculties of arts, engineering, economics and business, and science. In the study where the participants were asked whether they changed their way of teaching, it was found that two-thirds of the academic staff reported they made changes when teaching international students; surprisingly, however, it was the academic staff from soft disciplines (faculty of arts – 88%; economics and business – 68%) that opted for accommodation in their classrooms when compared to the staff from hard disciplines (engineering – 41%; science – 56%). This academic division can be further explored because according to Sawir's (ibid.) study, staff members from non-English speaking background showed more sensitivity to the language difficulties of their students. Therefore, further research is necessary to discover what other factors may be influencing EMI MPLS student achievement as reported in this paper.

On the other hand, when Dafouz, Camacho and Urquía (2014) investigated the disciplinary differences of EMI and non-EMI students in the three subjects (Financial Accounting, Principles of Business Financial Management, and Economic History), the students in history were found to perform slightly better than those in accounting and finance. The main reason for this difference is attributed to the "discourse distinctions among the subjects examined and/or qualitative variation in the way teacher assessment is implemented." (p.233). From a conceptual perspective, it is also claimed that the students studying the soft pure disciplines

(such as history) or Social Sciences (Business Administration as in this paper) can perform better because the content of the social sciences courses require the students to use more qualitative and explanatory resources and memorisation when making verbal arguments (Dafouz et al., ibid.). More research is still needed to understand the underlying other factors that lead to this difference between social sciences and MPLS; factors that can impact academic success can be investigated such as exam conditions or assessment procedures (Dafouz et al., ibid.) or language ability or academic self-concept (Neuman et al., 2019).

To conclude, with its original longitudinal pre-/post-test research design, the study in this paper showed that when English proficiency is improved, it impacts success in EMI Business Administration courses significantly more than the success in EMI Mechatronics Engineering courses. Therefore, regarding the role of language in learning academic subject content, the awareness of EMI lecturers not only in the Turkish context but also elsewhere should be raised especially in social sciences. However, we should bear in mind that there can be other factors that influence the success in the EMI courses.

Although no previous studies have conducted this exact same analysis examining the influence of a measure of English *improvement* on EMI academic success, some studies have investigated the relationship between English proficiency and success. In relation to these studies, Rose et al's (2019) findings in Japan are closely related to the current study. General English language proficiency was found to statistically significantly predict EMI success in Business Administration. Although not exactly the same research design, somewhat similar findings from such diverse contexts highlights the need to conduct replication studies on a larger scale, comparing more Divisions (including the Humanities and Medical Sciences), additional universities, and across different EMI contexts around the globe. This would provide evidence for further generalisability of whether English improvement positively influences EMI academic achievement.

In the Turkish context, findings related to English proficiency and EMI academic achievement in different academic disciplines have been contradictory. Curle et al. (2020a) did not find a statistically significant relationship in Economics (a Social Science subject). Contrastingly, Altay et al. (under review) found English proficiency predicted achievement in Social Science but not MPLS subjects. These studies, together with the current one, imply mixed results in terms of the relationship between English proficiency and academic success

overall, and also within each division. These contradictory results might stem from some other factors, i.e., language competences of the lecturers in different divisions (Dimova & Kling, 2018) or variety within the academic division (Dafouz, Camacho & Urquia, 2014), which call for further research. Although these studies are not a precise match to the current study, this highlights a need for replication research. Furthermore, the current as well as the aforementioned studies did not take EAP into account. Future research could investigate whether academic English (EAP) improves when studying through EMI. If so, this improvement could then be explored to see whether this predicts academic success in Social Science and MPLS subjects.

Concluding Comments

The idea that English language proficiency improves when studying through EMI emerged from empirical studies of lecturers' and students' perceptions. These studies unanimously found that stakeholders believe that EMI has a facilitative role in language development. Contrastingly, recent pre-/post-test designed studies comparing actual language development have shown mixed results. This highlights a discrepancy between perception and reality. The current study, with its rigorous design and precise focus, provides evidence that support stakeholders' views. However, more research is needed, particularly into the relationship between the improvement in English language proficiency and EMI academic success. This would provide precious insight into whether this relationship exists in different EMI contexts, in which subjects, and to what extent. Such knowledge would be key to gaining a deeper understanding of what affects student attainment, and how best to design relevant support programmes for EMI students.

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