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Examining the role of English language proficiency, language learning anxiety, and self-regulation skills in EMI students' academic success

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Abstract

This study focuses on the predictive power of linguistic (i.e., general English proficiency; identified simply as “proficiency” in this paper) and non-linguistic (i.e., language learning anxiety and self-regulation) factors on the academic success of English medium instruction (EMI) students studying in engineering and social sciences programs in a Turkish university setting. Data were collected from 705 conveniently sampled EMI students of four academic subjects

(international relations; $N = 158$; business administration; $N = 184$; mechatronics engineering; $N = 181$; mechanical engineering: $N = 182$) representing two disciplines (i.e., social sciences and engineering) from a public university. Pearson correlation and SEM analyses were run to determine the relationships among language learning anxiety, self-regulation, proficiency and EMI success. Findings revealed that anxiety and self-regulation skills do affect EMI students' proficiency irrespective of academic disciplines. Both self-regulation and proficiency impacted EMI students' academic success in engineering, while only proficiency predicted academic success in the social sciences. These results are discussed and pedagogical implications are given related to the impact of linguistic and non-linguistic factors in EMI contexts.

Keywords: English medium instruction; individual differences; general English proficiency academic success; discipline-based differences; structural equation modelling (SEM)

1. Introduction

Scholars concur that the number of English medium instruction (EMI) programs have increased exponentially in higher education (HE) institutions, notably since 2012 (Rose, McKinley, et al., 2020), because of globalization and internationalization (Galloway et al., 2020). EMI is defined as “the use of the English language to teach academic subjects (other than English itself) in countries or jurisdictions where the first language of the majority of the population is not English” (Macaro, 2018, p. 19). As a global educational phenomenon, EMI has been implemented in various contexts (McKinley & Galloway, 2022), including Turkey (Altay et al., 2022; Sahan et al., 2021; Soruç & Griffiths, 2018), where our study was conducted.

Different strands of EMI research can be identified in the literature. While earlier EMI research centered on specific language policies and their implementation in various contexts (e.g., Evans, 2000; Kirkgöz, 2009), more recent research has focused on beliefs, perceptions, and attitudes of students and teachers towards EMI (Macaro et al., 2018). Linguistic factors in EMI academic achievement, specifically the effect of language proficiency on academic success in EMI, has also been investigated (Curle et al., 2020; Rose, Curle, et al., 2020; Xie & Curle, 2022). In these studies, academic success entails the mastery of disciplinary knowledge and is usually measured by calculating the semester-long test scores of the students (Curle et al., 2020; Rose, Curle, et al., 2020). Although the relationship between individual differences (or non-linguistic factors) and academic success has been investigated with respect to, for example, self-efficacy and self-concept (Thompson et al., 2019), ideal L2 self (Rose, Curle, et al., 2020; Xie & Curle, 2022), mindsets (Kaya et al., 2021)

and motivation (Lasagabaster, 2016), there is an urgent need for research including other individual differences such as anxiety and self-regulation (Thompson et al., 2019). The current correlational design study, therefore, aimed to investigate the role of linguistic factors, that is, language proficiency, and that of non-linguistic factors, that is, anxiety and self-regulation, on EMI academic success by gathering data from both social sciences and engineering programs.

2. Literature review

2.1. English language proficiency and EMI academic success

The interplay between English language proficiency and academic attainment in EMI has been examined in a number of studies (e.g., Curle et al., 2020; Rose, Curle, et al., 2020; Thompson et al., 2019; Xie & Curle, 2022). In their study conducted with Year 2 students ($N = 139$) in a Japanese context, Thompson et al. (2019) found language proficiency (i.e., TOEIC scores) and preparatory performance (i.e., English for specific purposes, or ESP, course test scores) to be significant predictors of EMI success in an international business course. Similarly, when Rose, Curle, et al. (2020) investigated the relationship between TOEIC language proficiency scores and EMI international business course scores of Year 2 Japanese students ($N = 146$), they found a statistically significant relationship between language proficiency (i.e., TOEIC) and EMI success (i.e., content course scores). Another study on this relationship was conducted with Year 2 students ($N = 106$) in the Chinese higher education context by Xie and Curle (2022). They used their participants' Business English proficiency scores and content scores in an International Business course and found a statistically significant relationship between Business English proficiency and content scores (i.e., academic success). When Curle et al. (2020) examined this relationship in Turkey, with Year 4 students ($N = 212$) majoring in economics, they found contradictory results when compared to studies in the Japanese and Chinese contexts. In their study, general English proficiency, operationalized as scores on the Cambridge Preliminary English Test, was not a statistically significant predictor of EMI academic success.

Of these four studies, three have addressed the relationship between language proficiency and EMI academic success in international business courses in Asian contexts (Rose, Curle, et al., 2020; Thompson et al., 2019; Xie & Curle, 2022), while the remaining one (Curle et al., 2020) was conducted with economics students in the Turkish context. However, studies are still needed in programs other than international business courses or economics in EMI. Our study, therefore, extends the scope of the aforementioned research related to the role of language proficiency in EMI success in recruiting EMI engineering students, which is a common EMI discipline area (see Sandström & Neghina, 2017), as well as EMI

social sciences students, which is a more linguistically demanding discipline area (see Bolton & Kuteeva, 2012; Kuteeva & Airey, 2014). In our study, we maintain separate investigations into these different disciplines as the variation of EMI between them is worthy of investigation. More to the point, it is hypothesized that the comparison of multiple EMI programs from the same setting is most likely to yield more generalizable results in terms of the impact of language proficiency on academic success.

2.2. Language learning anxiety

Language learning anxiety refers to tendencies towards nervousness and hesitation when communicating or learning in second language contexts. At various levels, almost all language learners experience language-learning anxiety at some point in their language-learning process (Thompson & Lee, 2014) and there might be various anxiety levels for different skills (Cheng, 2017). Dörnyei and Ryan (2015) argue that without any doubt “anxiety affects L2 performance” (p. 176). Previous research that has investigated the interplay between language learning anxiety and various issues related to language attainment confirmed almost unequivocally that higher levels of language anxiety were closely connected with lower levels of language success or attainment (e.g., Zheng & Cheng, 2018). Hence, students’ self-regulation skills (see below) can be strengthened to moderate the negative effects of anxiety by helping them structure their learning environment (Zimmerman, 2002) and transmit their efforts to self-direct the learning process (Wang & Zhan, 2020). Anxiety caused by studying in English has been reported in numerous studies, which have generally examined the perceptions and responses of EMI students (e.g., Chun et al., 2017). Also, several studies have investigated the presence and/or types of speaking anxiety in EMI contexts (e.g., Suzuki et al., 2017). However, studies examining the relationship between language learning anxiety and academic success in EMI settings are rare (Macaro et al., 2018).

2.3. Self-regulation

Self-regulation refers to the ability of students to control, direct, and modify their learning experiences to become active agents of their own learning process (Zimmerman, 2002). According to Iwaniec (2014), self-regulation allows students to become more proactive in their learning and scaffolds them to reach their self-established goals. Self-regulation can be observed through dedication, commitment, and resilience towards a specific field of study or topic (Henry, 2019). The concepts of autonomy and self-regulation have also been used interchangeably in the field of language learning (Griffiths & Soruç, 2020). Self-regulation is therefore

accepted as a multi-faceted construct which contains “cognitive, metacognitive, motivational, behavioral, and environmental processes that learners can apply to enhance academic achievement” (Dörnyei, 2005, p. 191).

Previous research has provided strong evidence demonstrating the effects of the level of self-regulation on students’ learning outcomes (e.g., Bai & Wang, 2023; Zimmerman, 2008). In the field of language learning, for instance, self-regulation is considered a key aspect that leads to improved language competence (Bai, 2018). However, few studies have explored self-regulation in EMI contexts. In a study conducted in Hong Kong, Hu and Gao (2018) examined the processes of the utilization of resources in high-achieving and underachieving secondary students’ self-regulated strategic writing in their EMI academic studies. Their findings indicated that high achievers used a wider range of learning strategies compared to their low-achieving counterparts. In a recent study in the Turkish context, Soruç et al. (2022) found that self-regulation was a significant contributor to EMI students’ academic success both in engineering and social sciences disciplines. In this study, the self-efficacy of the students also contributed to the academic success of the students. Recent research in non-EMI contexts has examined the relationship between self-regulation and language learning anxiety (Guo et al., 2018; Wang & Zhan, 2020). To the best of our knowledge, no prior study has examined the co-impact of self-regulation and language learning anxiety in EMI contexts.

2.4. Non-linguistic factors as predictors of academic success in EMI

There is a strand of studies that examines the relationship between non-linguistic factors including motivation and EMI academic success. In one of the first studies, Lasagabaster (2016) investigated the interplay among motivation, gender, L1 and possible selves in English medium instruction (except for success). His findings demonstrated that ideal L2 self and integrativeness were positively correlated, indicating that the two factors tapped into the same domain and that the students had a positive attitude toward the second language. According to the proposed model, ideal L2 self, attitudes towards EMI, family influence and instrumental promotion accounted for 47.6% of the variance of the criterion measures. In their study, Thompson et al. (2019) explored the interplay among language proficiency, self-efficacy beliefs, self-concept, and EMI success, finding that L2 self-concept were not predictors of EMI academic attainment, while L2 self-efficacy was a significant predictor. The inconsistency of the relationship between non-linguistic factors and EMI academic success led Thompson et al. (2019) to call for further research in different academic subjects, other than internationally mediated EMI business course, as well as developing multi-item measures and different models based on more advanced statistical analyses such as structural equation modelling (SEM).

When Rose, Curle, et al. (2020) examined the relationship between motivation (i.e., ideal L2 self) and academic success, they found that motivation did not correlate with higher EMI success grades. Therefore, Rose, Curle, et al. (2020) argued that, because “EMI motivation warrants further investigation in future research” (p. 2158), alternative motivational constructs should be explored. Similarly, Xie and Curle (2022) investigated the interplay between motivation (i.e., ideal L2 self) and academic attainment. Their results demonstrated likewise that motivation did not predict EMI success. This result led Xie and Curle to “highlight the need for further research in this domain” (p. 594).

Table 1 Overview of the studies on non-linguistic factors and success in EMI

Studies on non-linguistic factors	Setting	EMI Course	Year of study	Number of participants	Non-linguistic factors	Key findings of the study
1 Lasagabaster, (2016)	Spain	Different EMI courses from four different faculties	various years of study	189	Ten factors including ideal L2 self	Ideal LE self and students' attitudes towards EMI significantly predicted their intended learning effort.
2 Thompson et al. (2019)	Japan	International business	Year 2	139	Self-concept and self-efficacy	L2 self-concept did not predict EMI academic success, while L2 self-efficacy was a significant predictor.
3 Rose, Curle, et al. (2020)	Japan	International business	Year 2	146	Motivation (i.e., ideal L2 self)	Motivation did not correlate with higher EMI success grades.
4 Xie & Curle (2022)	China	International business	Year 2	106	Motivation (i.e., ideal L2 self)	Motivation did not correlate with higher EMI success grades.

We argue that more specific research is needed in various EMI contexts or EMI academic disciplines because the studies in Table 1 are limited to one EMI subject: English-mediated international business. We still do not know, for instance, whether the same findings would be obtained if students from another EMI subject were surveyed, in particular such where English does not play an international role (Thompson et al., 2019). Besides, three studies out of four were conducted in the East Asian contexts of Japan and China, potentially limiting transferability to other EMI contexts. Based on the review of the literature above, the following specific gaps have been identified:

- Studies investigating the interplay between English language proficiency and EMI academic attainment did not yield conclusive results.

- The relationship between some individual differences (i.e., self-regulation and anxiety) has not yet been explored in EMI settings.
- The current research on academic success in EMI has generally sampled international business students, ignoring other disciplines.
- The relationship among linguistic and non-linguistic factors and EMI academic attainment has not been examined considering the EMI academic division or from the perspective of potential discipline-based differences (i.e., social sciences and engineering).
- Multi-item scales and different models of analysis, such as structural equation modelling (SEM), have not been used to explore the relationship between linguistic and non-linguistic factors and EMI success.

2.5. Proposing a hypothesized structural model

In this study, we hypothesized that language learning anxiety, self-regulation, and language proficiency would directly or indirectly predict EMI success. We also proposed that these three variables would have a direct or indirect impact on each other. Previous research in the field of second and foreign language learning settings identified a negative relationship between language learning anxiety and second language achievement (e.g., Oteir & Al-Otaibi, 2019; Teimouri et al., 2019). More specifically, a review of around 60 years of research in the field of language learning anxiety showed that anxiety was one of the major causes of lower language proficiency scores (Oteir & Al-Otaibi, 2019). In the field of second and foreign language learning, studies have revealed the positive impact of self-regulation skills on improving language proficiency (e.g., Andrade & Evans, 2013). Previous studies confirmed that self-regulation skills contribute positively to success in language learning (Oxford, 2011). In the field of EMI, a recent study by Soruç et al. (2022) confirmed the relationship between self-regulation and EMI success.

The interplay between language proficiency and EMI academic attainment has been proposed in recent research (e.g., Altay et al., 2022; Soruç et al., 2022), although there are mixed results regarding the effects of language proficiency and EMI academic attainment (e.g., Curle et al., 2020) and implications for discipline-based differences (e.g., Soruç et al., 2022). Our study aims to examine the relationship among these four constructs utilizing SEM (see Figure 1).

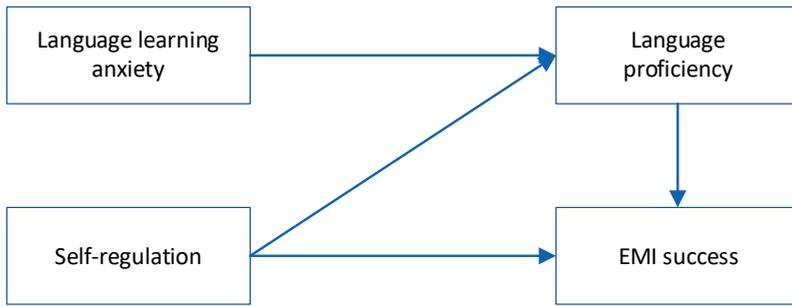


Figure 1 The rationale underlying the structural model hypothesized in this study

Based on our hypothesized structural model and responding to calls in previous studies (e.g., Thompson et al., 2019; Xie & Curle, 2022), the present study aimed to address the following research questions:

- RQ1a: To what extent do language learning anxiety, self-regulation, and language proficiency predict the success of EMI students in engineering programs?
- RQ1b: To what extent do language learning anxiety, self-regulation, and language proficiency predict the success of EMI students in social sciences?
- RQ2: To what extent do the SEM models produced for EMI programs from engineering and social sciences programs explain the relationship among learning anxiety, self-regulation, language proficiency and academic success?

3. Methodology

3.1. Research strategy

Correlational research design, a quantitative research method, was used in this study. Correlational studies explore the interplay among various variables measured at once without any intervention. The current study adopted a correlational research design because the interplay among university students' language learning anxiety, self-regulation skills, language proficiency and success in EMI courses, operationalized as grade point average (GPA) scores, were measured at one time.

3.2. Context of the study

Turkish higher education institutions offer two types of EMI programs: partial and full (Curle et al., 2020). The data for this study came from a partial EMI program, which is also described as a "multilingual model" (Macaro, 2018), where students are required to register for a minimum of two courses taught in English per semester. Data were collected from four partial EMI programs (i.e., two programs

from social sciences, two from engineering) of a major public university in Turkey with a population of more than 50,000 students, enabling the researchers to sample a higher number of EMI students from various EMI programs to examine any discipline-specific differences in terms of the relationship among linguistic and non-linguistic factors and EMI success. Selecting four EMI programs from the same setting further helped us to tackle potential subject-related confounding variables (e.g., Margić & Vodopija-Krstanović, 2018).

3.3. Participants

Data were collected from students who were conveniently sampled from EMI academic programs to represent two disciplines from a public university in the western part of Turkey (see Table 2 for details).

Table 2 Distribution of the participants according to the academic programs

Academic programs		<i>F</i> (%)	<i>M</i> (%)	Total (%)	Age (<i>M</i>) (<i>SD</i>)	Overall ratio of the whole sample
Social sciences	International relations	77 (49)	81 (51)	158 (100)	21.5 (3.1)	22.4%
	Business administration	86 (47)	98 (53)	184 (100)	23.8 (4.7)	26.1%
Engineering	Mechatronics engineering	52 (29)	129 (71)	181 (100)	24.3 (4.1)	25.7%
	Mechanical engineering	49 (27)	133 (73)	182 (100)	25.1 (5.2)	25.8%

In total, there were 705 participants from four EMI programs: 215 of the participants were second-year students (30.5%), 194 were from the third year (27.5%), and 296 were fourth-year students (42.0%). First-year students were not included because they did not have EMI success scores. A large proportion of participants were intentionally recruited from the four academic programs to run more reliable and valid analyses; for instance, structural equation modelling requires 150 or more participants as the ideal sampling size (Kline, 2011). Further details about the selection of the participants are the following:

- All participants had completed at least two years of study (data collection took place at the end of the academic year) in one of the four EMI programs.
- Turkish was the main language of all participants and they used English as a foreign language only. They all had comparable formal English language learning experiences within the Turkish education system including the higher education institution.
- No participant reported any high school EMI experience.

- All participants had taken the same assessments and exam procedures in their courses mitigating any testing effect on the scores used in this analysis.
- All participants had completed a minimum of eight EMI courses and 20 Turkish-medium instruction courses during their studies in their programs.

3.4. Data collection instruments and procedure

With the ethical clearance obtained, students were invited to participate in the study at the end of the academic year. The data related to the students' level of anxiety and self-regulation were collected via an online five-point Likert scale questionnaire (Iwaniec, 2014), while EMI course scores (GPAs) and language proficiency scores were obtained from the University Registrar's office. The whole process of data collection was conducted anonymously, and any personal identification information about participants was removed after determining the demographics. The following measures were used for language proficiency, success in EMI courses, anxiety, and self-regulation.

3.4.1. General English proficiency ("proficiency")

To determine participants' proficiency levels, a version of the Cambridge Preliminary English Test (PET) at a B1 difficulty level (Cambridge ESOL, 2014) was used. This proficiency test included questions on the four language skills: reading, writing, listening, and speaking. Since the university provides partial or full EMI programs, students are required to take this language test to measure their proficiency and when necessary to place the students in the appropriate level of language support classes. Even though the students took the tests in different years before starting their EMI programs, a very similar version of the Cambridge PET test was administered each year by the university administration.

3.4.2. EMI success

To measure EMI academic success, the sum of the final course scores for all content courses taken in English was divided by the number of English courses each student took. A minimum of 8 courses was determined as a unit threshold to be included in this study so that we could have robust evidence regarding our participants' EMI academic attainment. The fact that Year 1 students were not sampled for the present study can be considered from this point of view since an inadequate number of EMI courses was most likely to reduce the generalizability of the findings. Following earlier EMI success research (e.g., Rose, Curle, et al.,

2020; Thompson et al., 2019; Xie & Curle, 2022), we took the grade point average (GPA) scores of our participants as our measure of academic success.

3.4.3. Language Learning Anxiety Scale (LLAS)

A 5-point Likert scale was used to determine the extent to which the participants felt anxious when studying in English-medium instruction contexts (see Appendix A). We used the anxiety questionnaire developed by Iwaniec (2014), who modelled the items on the scale using Horwitz, Horwitz, and Cope's (1986) *Foreign Language Classroom Anxiety Scale*. The original scale included eight items, but this was reduced to five after the factor analyses (see details in the section on data analysis).

3.4.4. Self-Regulation Scale (SRS)

To collect the data about students' level of self-regulation in the EMI context, we used the scale with 12 items developed by Iwaniec (2014) (see Appendix B); however, after the factor analysis, just eight items were used in the analysis (see details in the section on data analysis).

3.5. Data analysis

Pearson correlation and SEM analyses were utilized to ascertain the relationships among language learning anxiety, self-regulation, language proficiency and EMI success. Maximum likelihood estimations were used in SEM. In the analyses, descriptive analysis and Pearson correlation coefficient analysis were performed using SPSS 21.0 and SEM was conducted using LISREL 8.54 programs.

3.5.1. Language Learning Anxiety Scale (LLAS)

A series of analyses were conducted to examine the validity and reliability of the original scale in the Turkish context. Firstly, all the assumptions for the factor analyses were checked, confirming the factorability of the correlation matrix. Then, an exploratory factor analysis (EFA) was conducted with the data from business administration students ($N = 184$) to explore the factor structure of the data. According to the analysis, items 1, 4, and 5 were removed, so the scale was formed by five items with one factor. A confirmatory factor analysis (CFA) was run, using the data from mechanical engineering students ($N = 182$) to test if the factor structure fits the data. The analysis showed that five items with one factor all pertained to the LLAS, measuring the same construct (i.e., anxiety) accurately and consistently. After this, Cronbach's alpha for internal reliability was examined

and the test returned an excellent value ($r = .91$). After all these analyses, the scale used in this study included five items (with one factor), measuring the level of anxiety of the students in the EMI context. According to the results of CFA and the values of Cronbach's alpha, LLAS is a valid and reliable instrument. Detailed results are presented in Appendix C.

3.5.2. Self-Regulation Scale (SRS)

To examine the validity and reliability of the SRS in the Turkish context, as in the anxiety scale, we carried out several analyses. After confirming the factorability of the correlation matrix, EFA was, firstly, run using the data of the participants from international relations ($N = 158$), according to which the items 2, 3, 9, and 10 were removed from the scale, and remaining was an eight-item scale with one factor (i.e., self-regulation). Immediately after this, CFA was run, using the data from mechatronics engineering students ($N = 181$). The analysis revealed that the eight items in the scale comprised a unified construct (i.e., self-regulation). Finally, when Cronbach's alpha for internal reliability was measured, the test returned an excellent value ($r = .96$). According to these analyses, we used an eight-item SRS with one factor. According to CFA and the values of Cronbach's alpha, SRS is a valid and reliable instrument. Detailed results are presented in Appendix A.

4. Findings

The data were analyzed separately for the engineering and the social sciences (RQ1a and RQ1b, respectively).

4.1. RQ1a: To what extent do language learning anxiety, self-regulation, and language proficiency predict the success of EMI students in engineering programs?

The data from 363 students (mechatronics; $N = 181$; mechanical engineering; $N = 182$) were analyzed, producing a model based on the variables *proficiency* (i.e., general English proficiency), *language learning anxiety*, *self-regulation*, and *overall EMI course scores*. Standard deviations and correlation coefficients are presented in Table 3. When the data were closely examined, all the means proved to be above average. When the relationship between the variables was analyzed, language learning anxiety was found to be negatively correlated with self-regulation ($r = -.41$). Also, language learning anxiety correlated negatively with proficiency ($r = -.32$) and EMI success ($r = -.11$). Furthermore, self-regulation had a positive correlation with proficiency ($r = .48$) and EMI success ($r = .24$).

Additionally, language proficiency was found to be positively correlated with the EMI success ($r = .31$).

Table 3 Mean, standard deviation and correlations among the variables

Variables	LLA	SR	Proficiency	EMI success
LLA	-			
SR	-.41**	-		
Proficiency	-.32**	.48**	-	
EMI success	-.11*	.24**	.31**	-
Mean	16.74	30.29	73.93	60.95
Standard deviation	4.62	6.36	7.35	14.22

Note. ** $p < .01$; * $p < .05$; LLA = language learning anxiety; SR = self-regulation; proficiency = general English proficiency; EMI success = GPA

To examine these relationships in more detail, in the second stage, SEM analysis was carried out. In this model, we found that language learning anxiety and self-regulation were predictors of proficiency, while self-regulation and language proficiency significantly predicted EMI academic attainment. The fit criteria used in the methodological literature (e.g., Kline, 2011) were followed when reporting the findings of the present study. According to the model, fit indices were $\chi^2/df = 0.15$, RMSEA = 0.001, SRMR = 0.054, AGFI = 0.99, GFI = 1.00, NFI = 1.00, CFI = 1.00. When these fit values obtained for the model were compared with the critical values determined for SEM by Schermelleh-Engel et al. (2003), the fit indices were in the range determined for a good fit, thus leading us to maintain that it was the tested structural model which provided the model-data fit. The path diagram containing the standardized path coefficients for the model is provided in Figure 2.

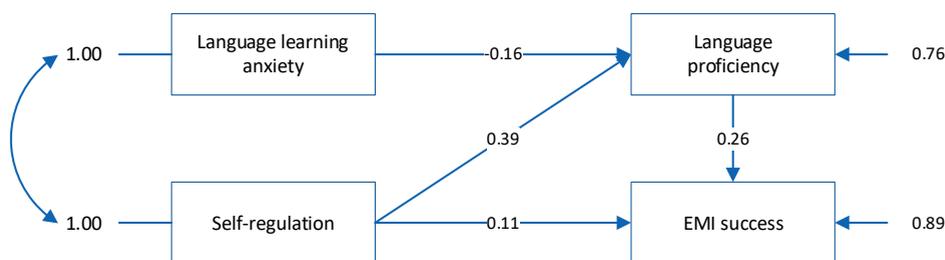


Figure 2 Standardized path coefficients calculated for the structural model

When the path diagram was examined, the path coefficients of some variables were low, and some were medium. In this respect, the standardized path coefficients obtained for the structural model and the t values and significance levels for these path coefficients are presented in Table 4.

Table 4 Standardized path coefficients, *t* values and significance levels regarding EMI courses GPA model

Direct effect	Standardized β value	<i>t</i>
LLA → proficiency	-0.16*	-3.20
SR → proficiency	0.39*	7.59
SR → EMI success	0.11*	2.02
proficiency → EMI success	0.26*	4.58

Note. * $p < .05$ LLA = Language learning anxiety; SR = Self-regulation; proficiency = general English proficiency; EMI success = GPA

When the data in Table 4 were closely examined, language learning anxiety ($\beta = -0.16$, $t = -3.20$) and self-regulation ($\beta = 0.39$, $t = 7.59$) were significant predictors of proficiency ($p < .05$). Furthermore, self-regulation ($\beta = 0.11$, $t = 2.02$) and proficiency ($\beta = 0.26$, $t = 4.58$) were significant predictors of EMI success ($p < .05$).

These data showed a negative relationship between language learning anxiety and proficiency; therefore, when students in EMI contexts had low anxiety levels, they developed higher language proficiency. Also, the self-regulation skills of the students were significant predictors of language proficiency, meaning that when students had a higher sense of self-regulation, they improved their proficiency. Both language learning anxiety and self-regulation skills accounted for 24% of proficiency.

Furthermore, in this EMI context, the self-regulation skills of the students were found to be significant predictors of EMI success, indicating that as students develop improved self-regulation skills, they become more successful in their EMI courses. Lastly, proficiency was also found to predict the students' EMI success significantly, which has revealed that as students become more proficient in English, they become more successful in EMI courses. The students' skills of self-regulation and their proficiency explained 11% of their EMI success, while the model also demonstrated that language learning anxiety impacted EMI success indirectly, explaining 5.6% of success in EMI.

4.2. RQ1b: To what extent do language learning anxiety, self-regulation, and language proficiency predict the success of EMI students in social sciences?

Following the same procedures as those outlined above, the data from 342 social sciences EMI students (international relations; $N = 158$; business administration; $N = 184$) were analyzed and then a model was produced based on the same variables as the engineering students. Standard deviations and correlation coefficient values are given in Table 5. Overall, the data showed that the variables had scores above the average, and we found that language learning anxiety was negatively correlated with self-regulation ($r = -.38$). Language learning anxiety was

likewise correlated negatively with proficiency ($r = -.34$) and EMI success ($r = -.12$). Conversely, self-regulation was correlated positively with proficiency ($r = .50$) and EMI success ($r = .21$). Additionally, proficiency was positively correlated with the EMI success ($r = .33$).

Table 5 Means, standard deviations and correlations among the variables

Variables	LLA	SR	Proficiency	EMI success
LLA	-			
SR	-.38**	-		
Proficiency	-.34**	.50**	-	
EMI success	-.12*	.21**	.33**	-
<i>M</i>	17.89	28.52	73.29	66.39
<i>SD</i>	3.40	6.23	7.10	11.76

Note. ** $p < .01$; * $p < .05$; LLA= Language learning anxiety; SR= Self-regulation; Proficiency = general English proficiency; EMI success = GPA

In the second stage, the SEM analysis yielded the same results as in the case of the engineering students. The same fit criteria used for the engineering student data were followed when reporting the findings of the social sciences student data. In this model, fit indices were $\chi^2/df = 0.25$, RMSEA = 0.001, SRMR = 0.093, AGFI = 1.00, GFI = 1.00, NFI = 1.00, CFI = 1.00. When these fit values obtained for the model were compared with the critical values determined for SEM, the fit indices were in the range determined for a good fit, indicating that the structural model tested here provided the model-data fit. The path diagram containing the standardized path coefficients for the model is presented in Figure 3.

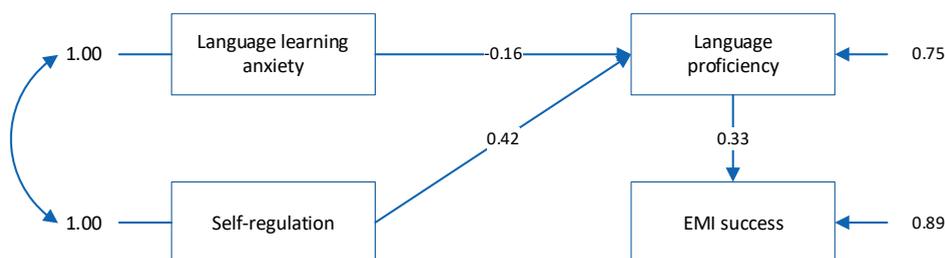


Figure 3 Standardized path coefficients calculated for the structural model

Analysis of the path diagram for the students of the social sciences, like the engineering students, showed that the path coefficients of some variables were low, and some were medium. In this respect, standardized path coefficients obtained for the structural model and the t values and significance levels for these path coefficients are presented in Table 6.

Table 6 Standardized path coefficients, *t* values and significance levels regarding EMI courses GPA model

Direct effect	Standardized β value	<i>t</i>
LLA → proficiency	-0.16*	-3.33
SR → proficiency	0.42*	8.56
proficiency → EMI success	0.33*	6.39

Note. * Significant at level $p < .05$; LLA = language learning anxiety; SR = self-regulation; proficiency = general English proficiency; EMI success = GPA

According to the data in Table 6, language learning anxiety ($\beta = 0.16$, $t = -3.33$) and self-regulation ($\beta = 0.42$, $t = 8.56$) were significant predictors of proficiency ($p < .05$). However, language proficiency ($\beta = 0.33$, $t = 6.39$) was the only significant predictor of EMI success ($p < .05$). Such results indicated that when social sciences EMI students feel less anxious (as engineering EMI students do), they develop higher language proficiency in EMI courses. Also, the data showed that self-regulation was a significant predictor of proficiency. Similar to engineering EMI students, students studying in social sciences EMI programs with higher self-regulation skills had improved language proficiency. Both anxiety and self-regulation account for 25% of improvement in proficiency.

Conversely, the non-linguistic factors of anxiety and self-regulation did not predict success in EMI programs in social sciences, whereas proficiency did. The model showed that as the students of the social sciences increased their language proficiency, they became more successful in EMI courses like international relations and business administration. Language proficiency explained 11% of EMI success. Although the impact was not found directly, anxiety and self-regulation both accounted for the EMI success, only 2.7%.

4.3. RQ2: To what extent do the SEM models produced for EMI programs from engineering and social sciences programs explain the interplay between learning anxiety, self-regulation, language proficiency and academic success?

The data showed that the language learning anxiety levels of engineering students were lower than the students from social sciences, while their self-regulation skills were higher. Related to their EMI success, however, the students in social sciences had higher GPA scores, but they were more anxious and their self-regulation skills were much lower. The fact that these two non-linguistic variables influenced each other negatively should be closely examined in future studies.

When the two SEM models were compared using Akaike's Information Criteria (AIC), Consistent AIC (CAIC) and Bayes Information Criteria (BIC), we found that the value of AIC for the model of Engineering programs was 18.15, while the value of CAIC was 62.20. The value of AIC for the programs in social sciences was

16.49, while CAIC was 55.17. Given that the better model was the one having the lower index scores, we can suggest that the SEM model produced for social science programs (i.e., international relations and business administration) showed more effectiveness than the other model produced for engineering programs. The main reason for this can be because the self-regulation skills of the engineering students predicted EMI success and that the model was more complicated.

When the two SEM models are compared, it can be maintained that EMI students' individual differences like anxiety and self-regulation predicted proficiency significantly, which explained one-fourth of the improvement in proficiency in both engineering and social sciences programs. Regarding academic success in EMI in both disciplines, proficiency was likewise found to be a significant predictor of EMI success. The only difference observed in both SEM models was about the self-regulation skills of the students. While this non-linguistic factor, or individual difference, was a significant contributor to the success of engineering EMI programs, it did not directly predict the success of students studying in the social sciences. Therefore, we suggest that not only proficiency but also the self-regulation skills of engineering students should be supported. This is not the same case in social sciences, because it was not self-regulation, but proficiency which contributed directly and significantly to the increase in students' success.

5. Discussion

Utilizing SEM, this study is among the first few studies to examine the relationship between linguistic (i.e., general English proficiency) and non-linguistic (i.e., language learning anxiety and self-regulation) factors and EMI students' academic success comparing engineering and social sciences students. The first research question asked whether EMI students' general English proficiency, sense of anxiety and self-regulation skills predicted their success in engineering EMI courses (RQ1a) and social science EMI courses (RQ1b). Our findings revealed that in both discipline areas, students' individual differences such as their level of language learning anxiety and sense of self-regulation skills predicted their level of language proficiency. For engineering students, language learning anxiety and self-regulation skills accounted for 24% of proficiency. Moreover, self-regulation and proficiency predicted EMI students' academic success explaining 11% of their EMI success. This finding is important for EMI practitioners or lecturers when teaching engineering students through EMI because, according to this finding, when these students are trained to be more self-regulatory and when they are more proficient in the language, it is more likely they will achieve success. Also, learning anxiety explained 5.6% of EMI success via proficiency indirectly. However, there was a negative relationship between language learning

anxiety and proficiency, indicating that when the students in engineering EMI programs had low anxiety levels, they developed higher language proficiency. This finding is vital to the EMI literature because no prior study has examined the predictive power of language proficiency, language learning anxiety and self-regulation skills on engineering students' academic success.

In the social sciences division, our results similarly demonstrated that language learning anxiety and self-regulation were significant predictors of students' proficiency. Anxiety and self-regulation accounted for 25% of improvement in proficiency. However, only proficiency significantly predicted EMI success accounting for 11% of students' level of success, while non-linguistic factors such as anxiety and self-regulation did not predict success in social sciences EMI programs. Although this finding suggests that anxiety and self-regulation skills are less important for social sciences students when compared to language proficiency level (see Kuteeva & Airey, 2014), we note that these non-linguistic factors still have an indirect effect. Regarding the relationship between language proficiency and EMI academic success, Thompson et al. (2019), Rose, Curle, et al. (2020), as well as Xie and Curle (2022) found language proficiency as a significant predictor of EMI success in social sciences programs. Our results support the findings of these studies, as we also found that English language proficiency, among other factors, predicted EMI students' academic success in the programs of social science. Given the fact that our participants were sampled from both international relations and business administration programs, including a higher number of students, these findings are transferable to other similar EMI settings.

In non-EMI contexts, previous studies reported a strong link between students' levels of self-regulation and their learning outcomes (e.g., Bai & Wang, 2023; Zimmerman, 2008). Similarly, for engineering students, a statistically significant relationship was found between self-regulation skills and academic success. However, we also found that self-regulation skills did not predict academic success in social sciences programs. These mixed findings should provide an impulse for further research because they emphasize the significance of discipline-based differences in EMI settings, as could be observed in some other studies (e.g., Altay et al., 2022).

While few studies have explored the relationship between language learning anxiety and academic success in EMI settings, in non-EMI settings, previous research demonstrated that higher levels of language anxiety were closely connected with lower levels of language success (e.g., Zheng & Cheng, 2018). Similarly, in our study, for both discipline areas, language anxiety exhibited significant correlations with English language proficiency, and in the engineering programs, it indirectly predicted EMI academic success via proficiency accounting for 5.6%

of EMI success. For social sciences students, conversely, language learning anxiety did not predict EMI academic success.

The second research question concerned the extent to which the SEM models produced for the EMI programs from engineering and social sciences explain the link between anxiety, self-regulation, proficiency and academic success. When comparing the SEM models produced for the two groups, we found that language learning anxiety levels of engineering students were lower than those of students from social sciences, while their self-regulation skills were higher. Lower language learning anxiety may be related to the varying role of the English language in engineering programs. Dearden and Macaro (2016) provided evidence regarding the varying role of language in EMI contexts, suggesting that EMI students as well as lecturers deal more with formulae than words. Similarly, Wellington and Osbourne (2001) claimed that the intensity of the language used in engineering programs might be low because students mostly depend on a combination of words, pictures, diagrams, images, animations, graphs, equations, tables and charts in these programs. However, in social sciences, students rely mostly on their English proficiency because the courses they take encourage them to use language more flexibly and creatively (Kuteeva & Airey, 2014). Dearden and Macaro (2016) also found that social science lecturers stated that they focus more on language issues because, according to the lecturers, teaching social sciences subjects requires students to be engaged in more communicative and small group activities, thus leading to more frequent dependence on language (Bolton & Kuteeva, 2012). These differences concerning language in different disciplines may help explain why social sciences students manifest higher levels of language learning anxiety.

6. Limitations

Although our study offers important contributions to the field of EMI, it also has some limitations to consider when interpreting the results and transferring the findings to other contexts. First, the findings of this study came from a partial (i.e., multilingual) EMI context in Turkey. While this is generalizable to other partial EMI contexts, studies could be carried out in full (or fuller) EMI contexts to increase the generalizability of the conclusions more broadly. Moreover, the participants and the academic divisions were sampled conveniently. Random selection of the participants could extend the validity of the study and it could produce different results. Also, in this study, we examined only two non-linguistic factors, namely, anxiety and self-regulation. Therefore, future studies could investigate other individual variables including instrumental and intrinsic motivation, self-efficacy, motivated behaviors, boredom, and so on. Due to the intensity of the

analysis, we reported only quantitative results without interviewing the participants. Future studies should also use qualitative data to support quantitative data. Finally, since the data were collected from 2nd, 3rd and 4th-year students, different anxiety or language proficiency may have occurred at different learning levels. Future research can be carried out with a single education level.

7. Implications for the teaching/learning

The main findings of our study revealed that anxiety and self-regulation skills do affect EMI students' English language proficiency in both academic disciplines. Moreover, we observed that both self-regulation and language proficiency impacted EMI students' academic success in engineering programs, whereas only English language proficiency impacted academic success in the social sciences discipline area. These two main findings indicate critical implications.

- First, English language proficiency contributes to the student's academic success in both academic areas (see also Yuksel et al., 2021); therefore, uninterrupted language support should be given to EMI students throughout their studies in order to boost their academic success. This language support can be in the form of in-session courses or English programs such as English for specific purposes and/or vocational English.
- Second, strategy instruction should be given to the learners related to their challenges (e.g., Soruç et al., 2018, 2021) considering their specific language proficiency level and the academic discipline. However, we note that continuous language instruction or systematic strategy training is not the only factor that paves the better road for students' academic success; students' sense of anxiety should also be reduced, and self-regulation skills should be equally supported.
- Finally, the self-regulation skills of engineering EMI students should be closely backed up through specific instructional, awareness-raising activities because it should be remembered that their self-regulation skills do affect their academic success as much as their language proficiency, while this may not be so significant in social sciences.

8. Conclusions

This study is the first to find that while both self-regulation and general English language proficiency were significant predictors of academic success in engineering programs, it was only language proficiency in social sciences programs found as the predictor of academic success. These findings have pedagogical implications

for EMI practitioners, lecturers, and higher education institutions because it explicitly highlights the importance of students' individual characteristics such as the role of self-regulation skills on EMI students' academic success, especially in engineering programs as well as the potential but unnoticed value of discipline-based differences in EMI settings. More meaningful and direct pedagogical interventions should therefore be implemented because EMI students in engineering programs might display different attitudes and have different needs from those studying in social sciences programs.

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APPENDIX A

Language Learning Anxiety Scale (LLAS)

1. *I tremble when I know I'm going to be called on in language class.
2. Even if I'm well prepared for the class, I feel anxious about it.
3. In language class, I can get so nervous that I forget things I know.
4. *I worry about the consequences of failing tests, assignments and exams in English.
5. *It embarrasses me to volunteer answers in my language class.
6. I feel more tense and nervous in my language class than in my other classes.
7. I'm afraid other students will laugh at me when I speak English.
8. I start to panic when I have to speak without preparation in language class.

* Items removed after the factor analyses.

APPENDIX B

Self-Regulation Scale (SRS)

1. If there is something I don't understand in English, I do my best to find the answer in a variety of resources (course books, dictionaries, online resources).
2. *If I can't understand something in the English class, I ask others (my English teacher, friends etc.) for help.
3. *I try to find opportunities to practise my English.
4. I try to prepare for every English lesson, even if I know that I won't be tested.
5. I try to learn English by watching films in English and listening to music in English.
6. I have my own ways of studying English vocabulary.
7. I plan my preparation and reviews before the test.
8. I have my own special techniques to make even the most boring activities more interesting.
9. *When studying English, I arrange my environment to make learning more efficient.
10. *I use my own techniques to keep me focused on studying English.
11. When studying English, I arrange my environment so that to avoid possible distractions (TV, the Internet, mobile phone).
12. I study English as long as it takes me to achieve my own goals.

* Items removed after the factor analyses.

APPENDIX C

Reliability coefficients and goodness of fit indexes of confirmatory factor analysis of scales

Scale	Total items	Factor loading	EV	Reliability	Standard lolution	Fit measure	Model value
Language learning anxiety	5	.539-.880	61.73	0.91	.69-.96	χ^2/df	1.697
						RMSEA	0.062
						SRMR	0.016
						CFI	0.99
						NFI	0.99
						NNFI	0.99
						GFI	0.99
Self-regulation	8	.719-.979	85.49	0.96	.53-.99	χ^2/df	1.879
						RMSEA	0.069
						SRMR	0.033
						CFI	0.99
						NFI	0.99
						NNFI	0.99
						GFI	0.96
AGFI	0.91						