Models of EMI pedagogies: at the interface of language use and interaction

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Abstract
Teachers in English-medium instruction (EMI) contexts have to contend with the pedagogical challenges associated with teaching academic content in a second language (L2). It has been suggested that EMI delivery may be improved through professional development (PD) opportunities. However, to ensure that PD is based on research evidence, an important first step is to explore ways in which current teacher pedagogies might be categorised based on language use. This study addresses this need by exploring differences in language use and classroom interaction as a component of EMI pedagogy. Data were collected through classroom observations (n=85) and interviews with 21 EMI engineering lecturers at seven universities in Turkey. Pedagogical practices were compared across university types (elite, large, and small) and between lecturers. The findings revealed significant differences in terms of the proportion of L1 use and teacher-student interaction by university type, with less L1 use and interaction found in EMI classes at elite universities. Four variations of EMI implementation were identified with respect to language use and interaction. That EMI education is implemented differently across university contexts and between classes within the same department has implications for learning outcomes. The findings are discussed with respect to EMI pedagogy and professional development.

Keywords
English medium instruction; interaction; code-switching; L1 use; Turkey; higher education

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1. Introduction

With the spread of English as the international language of research, science, and academia (Ammon, 2006; Coleman, 2006), higher education institutions (HEIs) across the non-Anglophone world have increasingly offered academic programs taught through the medium of English. Consequently, English medium instruction (EMI) has become prevalent at universities to prepare local students for the global job market and to increase the international profile of the university (Wächter & Maiworm, 2015).

In Turkey, where English is connected with concepts of modernization and Westernization, EMI has historically been associated with elite education (Selvi, 2014). However, throughout the last decade, the number of public universities in Turkey has increased dramatically through a government-led initiative to expand higher education starting in 2008. In 2005, there were 73 HEIs in Turkey; by 2010, the number of higher education institutions (HEIs) had increased to 156 (Günay & Günay, 2011); and in 2019, there were 207 HEIs (YÖK, 2019). The situation in Turkey now echoes similar trends in other EMI contexts, where universities, public and private, large and small, new and established, have to contend with the pedagogical challenges associated with teaching more academic content in a second language (L2).

Previous research on EMI has highlighted differences in the language used by lecturers in EMI classes, including the use of the first language (L1) when it is shared by the lecturer and students (e.g. Sahan, 2020). Research has also highlighted the fact that some EMI teachers' pedagogical approaches change in EMI settings, characterised by less interaction (Pun & MAcaro, 2020) and impoverished discourse (Lo & Macaro, 2012). It has been suggested that universities need to address these challenges through professional development (PD) opportunities to improve EMI delivery (Macaro, Akincioglu, & Han, 2020) and that this PD needs to go much further than mere improvement in English language proficiency (Bradford, 2018). However, not all teachers' PD needs are the same, so an important first step is to explore ways in which teacher pedagogies might be categorised based on language use. This information can then be used to target more appropriately teachers' EMI needs through PD programs.

Macaro (2018) has proposed four models of language support in EMI programmes: the multilingual model, in which students are offered access to L1 MoI alongside their EMI courses; the concurrent support model, in which student receive supplementary English support courses (typically in the form as ESP or EAP classes); the preparatory year model (PYP), in which students enrol in an intensive English program before beginning their EMI courses; and the selection model, in which students must pass an English proficiency test before enrolling to their EMI course but receive no additional language support. In Turkey, EMI programmes are structured according to the PYP model, through which students must successfully complete a one-year English program before enrolling on departmental courses. While these models theorize how institutions structure EMI programmes at a curricular level, research has yet to theorize models of EMI teachers' classroom practices. To address this gap, this paper reports on an investigation of language use and interaction in 85 observed EMI lectures of 21 EMI teachers in Turkey in order to explore whether it is possible to classify EMI pedagogies into types according to content teachers' practices.

2. At the nexus of language and pedagogy in EMI

With the expansion of EMI worldwide, many studies have examined language use in EMI contexts, typically focusing on teacher proficiency (Dimova & Kling, 2018), benefits of L1 as a pedagogic tool (Curle, et al, 2021; Tarnopolsky & Goodman, 2014), and approaches to teaching and learning (Lin, 2012). Some studies have found that EMI instructors tend to simplify their language to improve student comprehension during lectures (e.g. Sert, 2008), others that low teacher proficiency led to reduced quality of content teaching (Hu & Lei, 2014). Some studies have revealed that a lack of interaction between students and teachers means students have little opportunity to produce content knowledge in English (Pun & Macaro, 2019) and take a largely passive role. Two of the largest differences in EMI pedagogies that emerge are differences in the amount of L1 used in EMI classes, and differences in the amount of interaction between teachers and students.

2.1 Language use

The role of English in EMI has been examined by a number of scholars (e.g. Dafouz & Smit, 2016; Kuteeva, 2019; Macaro, 2020) who have suggested that the 'E' in EMI varies in terms of the type and quantity of English used. Li Wei and Martin (2009) argue that codeswitching is a natural bilingual behavior that only attracts attention in classrooms because language education policies tend to be shaped by top-down monolingual ideologies that ignore the possibility of multilingual use. Ferguson (2009) emphasized "the utility of CS [codeswitching] as a communicative and pedagogic resource in bilingual contexts, especially where pupils struggle to understand difficult subject matter whilst simultaneously learning a foreign language, one that is nominally the official medium of instruction" (p. 231). A proponent of L1 use in the classroom, Ferguson (2003; 2009) suggested that codeswitching facilitates the transmission of knowledge, classroom management, and establishment of rapport. Other research, however, has cautioned against excessive use of L1 in classrooms designed to act like immersion environments (McMillan & Turnbull, 2009).

Research analyzing the use of L1 in EMI tertiary classrooms has highlighted the negotiation of language choice. In an ethnographic study at a Swedish university, Söderlundh (2013) concluded that the norms of language choice were co-constructed by teachers and students, with English used for 'on-task' discussions, L1 used for closed discussions between L1 speakers, and codeswitching primarily used for single word translations. Similarly, Airey (2012) described EMI in the Swedish context as a situation of parallel language use, whereby course material was in English but lectures were often given in Swedish unless international students were present. Tarnopolsky and Goodman (2014) found that the L1 was used in EMI classrooms to establish rapport, discipline, and improve comprehension through explanations of content-specific terminology. Thus, research suggests that EMI classrooms often do not achieve the 'English-only immersion' envisioned by policymakers (Evans, 2008, p. 495), but codeswitching and L1 use are common phenomena serving a variety of purposes.

Although codeswitching has been identified as a common classroom practice, some research has suggested that L1 use is related to the low L2

proficiency of teachers (Hu & Lei, 2014). A study by Lasagabaster (2017) on CLIL[i] teachers' beliefs on L1 use in Spain found that more experienced teachers reported using English-only to maximize students' exposure to the L2, whereas the least experienced teacher reported using the L1 and L2 interchangeably. The study also found that, some teachers were opposed to language mixing for instructional or assessment purposes. Other research into CLIL and EMI has suggested that the proportion of L1 and L2 use by teachers varies considerably. Lo and Macaro (2012) for example, found that Hong Kong schools varied in their implementation of EMI, with average proportions of L2 use ranging from 19.8% to 79.3% in Grade 10 lessons in one type of school, compared to 96.8% in English in another type of school. These findings suggest that teachers' language practices may vary across EMI institutions.

Several studies have indicated that EMI lecturers prioritized content over language in their classes (e.g. Airey, 2012; Block & Moncada-Comas, 2019; Unterberger, 2012), but little is known about broader patterns of teacher and student talk. The current study contributes to this research by following Duran and Sert's (2019) recommendation that future studies examine aspects of EMI classroom interaction such as codeswitching to explore differences in teachers' use of language as a component of EMI pedagogy.

2.2 Language and pedagogy

Often, concerns related to language proficiency overlap with pedagogical issues in the EMI classroom and particularly with levels of teacher-student interaction. Gundermann (2014, p. 266) has noted that EMI classrooms are not 'culture-free' contexts, suggesting that language proficiency is often conflated with cultural differences in expectations of teaching and learning. She has argued that cultural problems are often framed as linguistic problems, resulting in student criticism of a lecturer's English proficiency to mask complaints about teaching style. Ball and Lindsay (2013) suggest that EMI teaching, in contrast to lecturing in the L1, requires a re-evaluation of the teaching methods used. Other scholars have similarly suggested that student-centered learning is an effective pedagogical approach in EMI classrooms because it encourages students to use English actively to display content knowledge (Wilkinson, 2013). This also echoes effective pedagogical practices in science classrooms that shows teacher-student interaction to be a core part of the learning process (see Mortimer & Scott, 2003).

While research has underlined the benefits of dialogical approaches to teaching in EMI contexts, studies have found that EMI classrooms are less interactive than L1 learning environments (e.g. Lo & Macaro, 2012; Pun & Macaro, 2019). Lo and Macaro (2012, p. 29) investigated the effects that language of instruction (L1 medium or EMI) had on classroom interaction in secondary schools in Hong Kong, concluding that L2 instruction resulted in more teacher-centered classrooms with "fewer opportunities for negotiation of meaning and scaffolding". Moreover, EMI classes contained shorter interaction sequences and fewer opportunities to scaffold content. Similarly, Inbar-Lourie and Donitsa-Schmidt (2013) have suggested that the structure of EMI courses is typically characterized by input-based instruction.

2.3 The interface of language use and interaction

Much of the research on pedagogical approaches and L1 use in EMI has been limited to single case studies of single programs, making it difficult to draw meaningful conclusions for a wide range of EMI educational contexts. Additionally, much of the research has relied on indirect measures such as interview, focus group, and questionnaire data rather than a direct examination of classroom practices. To fill this gap, the current study drew from a substantial corpus of 85 EMI classes by 21 teachers in 7 institutions to answer the following questions:

1. How does EMI implementation vary according to the type of university?
2. How do EMI teachers differ in terms of their L2 use and interactional approaches?

3. Methodology

Data were collected through classroom observations and interviews at universities in Turkey. As pedagogical approaches have been shown to be influenced by the type of university, the study sampled a diverse range of universities along key dimensions:

- university size—as large universities consist of multiple faculties, whereas small universities in Turkey are typically limited to one or two specialized academic fields and thus economies of scale may pertain;
- elite status—as elite universities have a much longer tradition of teaching through English and may experience different pedagogical challenges;
- geographic location—as more remote universities might not have the same level of access to staff with the linguistic resources to teach in English.

Lecturers and administrators at 14 different universities were contacted and invited to participate. Of the 14 universities approached, lecturers from 7 universities agreed to participate. The final sample included five universities in Western Anatolia and two universities in Central Anatolia; no universities from Eastern Anatolia were included in the sample, although two were contacted and declined to participate. At the time of data collection, Turkey was under a state of emergency, and university employees were under intense government scrutiny. The political climate created obstacles in terms of access, especially for outside researchers, and affected some potential participants' willingness to join the study. A summary of the participating universities is outlined in Table 1.

[Table 1: See appendix]

As the aim of the study was to compare teachers across universities, we minimized other areas of divergence. Engineering was selected as the discipline of study because it is a discipline commonly taught through EMI in Turkey and is considered a prestigious subject in Turkey (ÖSYM, 2017). Engineering is also considered a 'hard' EMI subject, meaning that English is

not overtly connected with the discipline itself (see Macaro, 2020) in the way that, say, International Business Studies is. Further to this, as engineering is connected to (local and global) industry, it has practical linguistic needs (e.g. to communicate with industry).

3.1 Participants

From the seven universities, 21 EMI university lecturers (henceforth, teachers) participated in the study. All were Turkish nationals, and they were employed as full-time staff at their institutions, with both teaching and research responsibilities. They were all teaching content subjects as part of an engineering degree at the undergraduate level. The teachers were predominantly male (n=19). Seven of them had received their PhDs in Turkey, the remainder had received doctorates from the U.S. (n=10), Switzerland (n=2), Germany (n=1), and the U.K. (n=1). The majority of teachers (n=19) had not received any kind of pre-service training or in-service PD, including training related to EMI teaching. The two teachers who indicated that they had received teacher training stated that this was of short duration and was required for their teaching assistant work while undertaking their PhDs. The participants had a minimum of one-year university teaching experience through EMI. All six of the teachers at the two elite universities had only ever taught through English. Although some teachers stated in interviews that it was easier for them to lecture in English than in L1 (n=3), the teachers in this study indicated that they were teaching through English because institutional or departmental policy required them to do so. An overview of the participants is provided in Table 2.

[Table 2 See appendix]

3.2 Data collection

In total 85 classes were observed and audio-recorded, with an average class time for each lesson of 47 minutes 44 seconds (M = 47.74, SD = 12.52). An average of 3 hours 10 minutes 8 seconds was observed per teacher (M = 190.13 minutes, SD = 51.95), with an average of four observations per teacher. Differences in length exist because class times varied across the universities, and it was important to observe the full class length to capture pedagogical approaches at different stages of the lesson. The classes were structured such that two sets of observations were conducted per teacher. After each set of observations, a follow-up interview was conducted with the teacher for a total of 42 interviews, or two per teacher. For all observations, the first author was present to make notes of physical interaction and use of visual materials (such as writing on the whiteboard). These were then integrated into the transcripts of the observational data.

3.3 Data analysis

The audio-recordings were analysed to compare L1 use and interaction patterns in the EMI classes. L1 use and interaction were selected as two key categories of analysis because language choice reflects the de facto MoI of the lessons (e.g. EMI or L1 medium), and teacher-student interaction is a significant pedagogical resource for learning in the classroom (Mortimer & Scott, 2003).

A structured coding scheme for classroom observations was adapted from Tsui (1985) to measure language use, codeswitching, speaker, and function. The structured coding scheme consisted of six language categories: pause (0), English (L2), English with Turkish lexical items (E-t), inter-sentential codemixing (L1/L2), Turkish with English lexical items (T-e), and Turkish (L1). These categories were created to capture the fluidity of language use in EMI classrooms by segmenting coding units according to longer utterances for analysis, rather than assessing the proportion of language use according to measurements taken at distinct moments of time (e.g. according to a 5-second sample technique, as in Lo & Macaro, 2012) or through word count (e.g. as in Macaro, Tian, & Chu, 2020). The 'speaker' sub-categories in the coding frame included categories for 'teacher-talk' (e.g. lecture-style monologue), 'student-talk' (lengthy discussions or responses from students) as well as a separate category for 'teacher-student interaction' to capture quick question and answer responses between the teachers and students which were in the form of short responses from students of less than 3 seconds.

Three transcripts, selected at random, were chosen to assess the reliability of the coding scheme. Inter-rater reliability was assessed with the help of a Turkish-English bilingual colleague who holds a PhD in Applied Linguistics. After a training session on the coding scheme, the three transcripts were sent to the second rater for independent coding. Cohen's kappa (κ) was calculated to determine agreement between the rater and lead researcher, and an acceptable level of agreement was found between the two raters' overall judgements for the coding of language ($\kappa = 0.939$ (95% CI), $p < .001$) and speaker ($\kappa = 0.987$ to 0.987 (95% CI), $p < .001$).

4. Findings

4.1 How does EMI implementation vary across university types?

Using the data from classroom observations, language practices were compared across university types: elite, large, and small state universities. Kruskal-Wallis tests were conducted to see whether statistically significant differences existed between groups with respect to language use, codeswitching, speaker, and function—the categories of the structured coding scheme. Results revealed that there were statistically significant differences in terms of the proportion of L1 use ($H(2)=6.917$, $p = 0.031$) and teacher-student interaction ($H(2)=7.720$, $p = 0.021$) in EMI classes by university type. Pairwise comparisons showed that there were significant differences in the proportion of Turkish use ($p = 0.027$, $r = 0.725$) and teacher-student interaction ($p = 0.020$, $r = 0.754$) at elite and small universities (Table 3). No other statistically significant differences were found between groups with respect to the categories of the structured coding scheme.

[Table 3 See appendix]

When classroom language practices were compared by university type, the proportion of language use and speaker talk time at large and small universities varied both within and across institutions. Comparatively, there appeared to be less variation in the language practices of EMI lessons at elite universities, which were characterized by English-dominant, teacher-centered lectures with little teacher-student interaction. That is, elite universities tended

to offer students a more uniform EMI classroom experience in terms of L2 use and levels of interaction—albeit with lower levels of interaction. At other universities, this pattern was less uniform, and thus it was necessary to explore this data according to the individual teachers themselves.

4.2 How do EMI teachers differ in terms of their L2 use and interactional approaches?

The data from classroom observations were then plotted for each participant teacher in order to visually explore language practices at the classroom level. Figure 1 shows the average proportion of Turkish use (including Turkish with English lexical items) and teacher-student interaction for each teacher's class. Turkish use is aggregated to include instances of intra-sentential codeswitching[ii] (categories L1 and T-e), and points are labelled according to teacher and university. This figure visually confirmed that language practices at elite universities (clustered together on the graph) appeared to be characterized by low levels of Turkish use and low levels of teacher-student interaction. In contrast, L1 use and interaction varied at small and large universities, which appear 'scattered' across the graph, with six teachers' classes in which Turkish was used more than 50% of the time, and five teachers' classes in which teacher-student interaction consisted of more than one-third the lesson.

[Figure 1 See appendix]

4.3 What models of EMI pedagogies exist in terms of language use and interaction?

Four variations of EMI implementation were identified with respect to language use and interaction, situated along these two key dimensions. A fifth single case outlier was apparent when pauses were considered in terms of language use. These dimensions are presented in the form of vignettes comprising of qualitative observational data and post-observation interviews with the teachers which shed light on how and why these differences existed.

[Figure 2 See appendix]

4.3.1 Vignette 1: English-dominant, teacher-centered

The majority of EMI classes observed (n=11) were English-dominant, teacher-centered lectures. In other words, in these classes, the majority of the lecture was taught in English with teacher-talk comprising the greatest proportion of speaker time. They were characterized by relatively low levels of teacher-student interaction and L1 use. EMI classes taught through this type of pedagogy were observed at six of the seven universities. Notably, all of the six classes observed at elite universities were characterized under this pedagogical model.

English-dominant, teacher-centered lectures often involved problem-solving and the presentation of content on the chalkboard or white board, with the teacher commonly drawing figures or diagrams on the board. The average proportion of English used in these classes was 78.8%, compared to an overall average of 56.4%, and the average proportion of Turkish use (including insertional codeswitching) was 5.80%, compared to an overall average of

23.5%.[iii] Turkish was used to draw students' attention to a particular point being made, check comprehension, and discuss 'off-topic' aspects of the course, such as homework and exam dates. While these teachers appeared to adhere to a (mostly) English-only policy during the 'official' boundaries of the lesson, i.e. when they were lecturing in class, many were willing to use Turkish *outside* the 'official' boundaries of the lesson, such as after the lecture had ended, during office hours, or during breaks between class. Less teacher-student interaction was observed in these classes compared to others in the sample (11.7%, compared to an overall average of 20.7%). Student participation occurred in both the L1 and the L2, but teachers in these classes typically responded in the L2, such as in Extract 1 taken from a 3rd-year Mechanics of Materials course:

> **Extract 1**
> T: This is v max, is P-L-Q cubed over three.
> S: Türevi alıp sıfıra eşitledik ama. [*But we took the derivative and set it equal to zero.*]
> T: Sorry?
> S: Türevi alıp sıfıra eşitledik ama, ama üstte– [W*e took the derivative and set it equal to zero, but, but on top*--]
> T: Which one?
> S: Üstteki denklemde v'yi bulurken, iki bolu üç olması gerekmiyor mu? [*When finding v in the equation on top, doesn't it have to be two divided by three?*]
> T: Uh. It should be third. Which is also in the handout, so I don't see any problem with that.
> *(T-8, Elite-1, Observation 3)*

In this extract, the student asked a question in Turkish about the equation on the board. The teacher asked him to repeat his question, which he did in Turkish. The teacher responded, in English, with little elaboration. Rather than respond in Turkish or ask the student to repeat the question in English (e.g. in an attempt to police the language of instruction), the teacher ignored the codeswitch and proceeded with her lecture in English. When asked in a post-observation interview about the students' use of Turkish to ask questions in class, Teacher 8 stated: *"I don't know [why they ask in Turkish], I think that they're more comfortable asking in Turkish, or maybe they're shy and they don't want to ask in English or they don't think they can. I, I really don't know."*

While some teachers did occasionally respond to student questions or provide clarifying summaries in Turkish, this practice was not the norm in English-dominant, teacher-centered lectures. Instead, most teachers responded in English, even when students asked questions in Turkish. Of the 11 teachers whose classes were found to be English-dominant, teacher-centered lectures, four teachers provided L1 support and offered summaries in the L1 when needed at least once during the classroom observations. However, the teachers did not typically use Turkish as part of the lecture to 'teach' content in these classes, thus upholding English as the primary medium of instruction.

4.3.2 Vignette 2: English-dominant, interactive

This category includes language practices in EMI classrooms that were predominantly conducted in English and in which (relatively) high levels of teacher-student interaction were observed (30.2%, compared to an overall average of 11.7% in Vignette 1). These practices appeared in only four EMI classrooms at two universities, Small-2 and Large-2. Teacher-talk comprised an average proportion of 50.1% of class time, nearly all of which was in English (97.9%). Overall English-use comprised an average of 68.0%, which was slightly lower than in Vignette 1. However, 70.7% of teacher-student interaction and 38.2% of student-talk occurred in the L2, compared to 49.0% of interaction and 25.0% of student-talk for Vignette 1.

In interviews, the teachers explained that, to increase student involvement in the lessons, they strived to scaffold language and content. This approach allowed them to cope with low levels of student English proficiency and ensure that students were following the lesson. In practice, this meant that teachers created opportunities for students to participate in class in English. In one teacher's class (Teacher 6, Small-2), students were asked to give recaps or summaries of the previous lesson, which provided a space for student talk in English. More commonly in these classes, the teachers structured their lectures to include a high number of questions posed to students. Often, these questions were low-order thinking questions and required short responses. While this limited the complexity of student responses, it also lessened the linguistic burden on students who were learning and usually responding through an L2. An example of such questioning throughout the lecture is provided in Extract 2 taken from a 2nd-year Environmental Chemistry class in an Environmental Engineering department.

Extract 2

T: By the way, uh, when I say solubility, uh, remember there was a class in Eviron--Environmental Chemistry One, we studied solids. Suspended solids, dissolved solids, separable solids. So, which one is--
S1: Dissolved
T: Dissolved solids! Right? Anything is smaller than what diameter, do you think, we consider as solid?
S2: Zero point forty five uh--
S3: Forty five micro--
S2: Evet *[yes]*, micro.
T: Forty five or zero point forty five?
Ss: Zero point forty five.
T: So anything less zero point forty five micro we consider as a dissolved solid. What are dissolved solids? They are ions or they are particles?
S2: Particles
S1: Ions
T: Ions, mostly they are ions, right?
(T-17, Large-2, Observation 1)

Interaction in these classes was characterized by rapid, back-and-forth dialogue between teacher and students in English, where the teachers prompted students with simple questions, often presenting possible responses (‘*What are dissolved solids? They are ions or they are particles?’*), and

student responses typically consisted of one word answers (*particles; ions*) rather than full sentences. Higher order questions from teachers or students, in the L1 or the L2, were not common in these classes. Similarly, students rarely initiated question sequences or asked for clarification of content. While this limited the complexity of student output, this pedagogical approach encouraged student participation, and provided the teacher with a mechanism to ensure that students were following course content while asserting English as the primary MoI.

4.3.3 Vignette 3: L1-dominant, interactive lectures

A third category of EMI classes were (relatively) interactive classes that predominantly used the L1 as a medium of instruction. In four EMI classes at three universities (Small-1 = 2; Small-2 = 1; Large-3 = 1), the classroom language practices were characterized by high average proportions of Turkish use, particularly Turkish with English technical terminology (71.9%, compared to an overall average of 23.5%), and higher levels of teacher-student interaction (36.5%, compared to an overall average of 20.7%). The teachers in this group recognized that their lectures were, on paper, EMI courses and, in interviews, acknowledged that they were deviating from official university policy. However, they stated that they were lecturing (primarily) in Turkish for the benefit of the students, whom they described as having low levels of English proficiency which would prevent them from engaging with course content in English: *"I'm speaking Turkish but it's still like this. If it were in English, participation would be zero"* (T-1, Small-1, interview 1).

In these classes, English entered the lesson mainly in the written form and in the technical terminology used to discuss scientific concepts. English slides, resources, and materials were used throughout the lessons, and the teachers commonly wrote on the board in English. Additionally, English terms were used in spoken discourse to elaborate on scientific concepts, so these classes were characterized by high levels of insertional codeswitching. Extract 3 illustrates the fluidity of language use in one of the classes.

Extract 3:

T: Evet, şimdi bir soru çözelim. Değil mi? Bu free body diagram olayını artık anlayalım. Example'le daha iyi olacak diye düşünüyorum. <reading> The box weighs five, fifty newton and geometry is as shown. The forces in the ropes, find the forces in the ropes a-b and a-c. <reading ends> Çok temel bir soru, çok basit bir şey. Burada önemli olan free body diagramı çizmek. Neyi soruyor? a-b ve a-c iplerindeki?
[*...Here the important thing is to draw the free body diagram. What is it asking? At the ropes a-b and a-c?*]
S1: Kuvvetleri [*Their forces.*]
T: Kuvvetleri soruyor. Ne yapacağız o zaman? Çizeyim mi sizce, yoksa? Ekrandan mı bakalım? Gerek var mı?
[*It's asking for their forces. What are we going to do then? Do you think I should draw it or? Should we look at it on the screen? Is it necessary?*
S2: Ekrandan. *[On the screen*]
T: Ekrandan bakalım. [*Let's look at it on the screen*.]

(T-1, Small-1, Observation 3)

Here, although the teacher taught predominantly in Turkish, he used English words in explanations, such 'free body diagram' and 'example' rather than the Turkish equivalents (*serbest cisim diyagramı; örnek*). In the extract, the teacher read aloud the slide in English before summarizing the problem in Turkish and asking students how they would like to solve it. Although the teacher provided a short summary in Turkish, the students appeared able to comprehend the English-language slides. In these classes, the teachers explained course content in Turkish but used English terminology to describe technical concepts, thus exposing them to English, rather than Turkish, technical vocabulary. Given the fluidity with which English terms were used in these courses—often without any Turkish translation or explicit definition—students appeared able to comprehend technical jargon in English as a result of this style of teaching. However, despite the relatively high levels of teacher-student interaction found in these classes, teachers rarely asked higher-order questions, even in Turkish, as demonstrated in Extract 3.

4.3.4 Vignette 4: L1-dominant, teacher-centered

A fourth type of EMI lecture was L1-dominant and teacher-centered. Such language practices were found only in Teacher-21's class at Large-3. Turkish use accounted for an average of 66.2% of class time, compared with overall average of 15.4%. No English utterances in the form of full sentences or extended phrases were recorded in this teacher's class. Teacher-student interaction accounted for 15.5% of class time on average, which is less than both the overall average (20.66%) and the average for other Turkish-dominant classes (36.5%). T-21 stated that he was teaching this particular EMI course in Turkish because the students in this class asked him to do so, even though the official MoI was English. As he describes:

> "I teach in Turkish because the students asked me to. There are no foreign students, so I said okay.… Last semester, I taught this class in English, but this time the students all asked for Turkish, so I said okay.… So, for example, last term, I taught two sections of the same course, and I taught one in English because a few students wanted it, uh, we had some foreign students, and then I taught the other in Turkish because some students wanted Turkish… If we can do that, I mean, the schedules have to work but sometimes I don't know what else to do. *(T-21, Large-3, Interview 1)*

Although the lecture was given in Turkish, Teacher 21 wrote on the board exclusively in English and labelled graphs and diagrams in English. In doing so, he provided in written form the English terms for what he was explaining in Turkish. Unlike other Turkish-dominant lectures in which English scientific terms frequently appeared in place of their Turkish equivalents, T-21's use of English terminology was sparing and often used to refer specific variables or aspects of a problem rather than used to discuss a scientific concept in general. Despite Turkish serving as the MoI, student talk in these classes was limited, both in terms of quality and quantity, as demonstrated in Extract 4, which has been translated to English. The original dialogue occurred entirely in Turkish.

Extract 4:

T: On which side the measurement was taken, might not be given—it might not be stated. Will we be able to understand? What do you think, at which point on this transformer was the experiment conducted? I mean, where did they leave it open, where did they apply voltage?
S1: They applied eight thousand volts.
T: Where is eight thousand volts?
S1: At the entrance.
T: At the primer. In that case where has been left open?
Ss: The secondary.
T: It goes without saying, eight thousand volts is the rated voltage of where? The primer.

(T-21, Large-3, Observation 2)

Although this exchange between teacher and students occurred entirely in the L1, student output is limited to simple sentences and one-word responses. Students rarely responded to higher order questions in these classes. Instead, students primarily listened to the lecture in Turkish and provided short answers to questions posed by the teacher.

5. Discussion

The findings have provided an overview of the language practices observed in EMI classes with respect to language choice and teacher-student interaction. Four types of EMI implementation were observed. That EMI education is implemented differently across university contexts and between classes within the same department has implications for the quality of education and learning outcomes.

Classroom observation data revealed that the L1 was commonly incorporated into EMI lectures and the majority of codeswitching instances were initiated by teachers, which is not surprising given the teacher centeredness of many of the observed classrooms. These findings add to a growing body of research which suggests that the L1 is commonly used in EMI classes (e.g. Airey, 2012; Aizawa & Rose, 2019; Evans, 2008; Söderlundh, 2013; Tarnopolsky & Goodman, 2014), and that EMI does not mean English-only in many contexts. In fact, to varying extents, all four models of teaching might best be described as bilingual. The findings from the observation data were supported by interviews, in which teachers reported perceiving the L1 as a useful or unavoidable resource for content learning (e.g. Lin, 2012; Lin & Lo, 2017; Pun & Macaro, 2019). The student profile in the L1-dominant EMI classes may have contributed to this finding: the EMI classes included in the sample consisted primarily of home (local, Turkish) students who shared an L1 with their teachers (also Turkish nationals). Because participant teachers and students shared an L1, they may have been inclined to choose the "path of least linguistic resistance" (Söderlundh, 2012, p. 101).

The findings also indicated significant differences between universities according to type (e.g. elite and small universities) with respect to Turkish use and teacher-student interaction. These findings might indicate that elite universities are markedly differently in terms of their provision of EMI. These

findings echo those of a study conducted by Macaro, Tian, & Chu, 2020, which found low proportions of L1 use in five teachers' lectures at a university in China, which was reported as "one of the top ten universities in China" (5). Together with the results of this study, these findings suggest that the profile of the HEI and its students may contribute to differences in EMI implementation, particularly with respect to L1 use.

Our findings suggest that the L1 might be a useful pedagogical resource when used to encourage student participation and engagement in EMI classes—at least in learning environments similar to the ones in this study in which all or the vast majority of students share an L1. However more research is need in order to establish if this is indeed the case. Student-talk was found to occur most often in Turkish, and Turkish was also used in the majority of teacher-student interactions. Although the results of this study do not go so far as to suggest a relationship between L1 use and teacher-student interaction, other research looking at EMI classroom interaction has found that EMI classrooms were less interactive than L1 learning environments (e.g. Lo & Macaro, 2012; Pun & Macaro, 2019). In their study on the effect of L1 and L2 on question type in EMI science classrooms, Pun and Macaro (2019) found that "L1 use appears to be associated with higher order questions; higher order questions and quality interaction more generally have in the past been shown to lead to better learning" (p. 72). This study differed from these findings in that observations of higher-order questions were rare, regardless of language use, and that it was in university contexts rather than secondary schools. However, this finding with respect to question type is similar to that of Hu and Duan's (2019) study at Chinese university.

The results of this study have indicated that (relatively) higher levels of student participation can be achieved in EMI university classes through student-centered pedagogical techniques. Although research on EMI pedagogy is limited (Macaro et al., 2018), researchers have suggested that EMI teaching requires a re-evaluation of the methodological approaches used by content instructors (Ball & Lindsay, 2013) and have suggested that student-centered learning might be an effective pedagogical approach (Wilkinson, 2013). Such pedagogy might resemble the teaching strategies presented in Vignette 2. Classroom observation data found that, in these lectures, teachers worked to scaffold language and content through questioning techniques that increased student participation in English. This in turn may lead to a virtuous circle whereby greater student participation in L2 can gradually increase their proficiency and their confidence thereby facilitating higher levels of L2 use by all participants. Future research can explore whether this type of pedagogy indeed leads to better student outcomes compared to other types. However, we should note that the *quality* of student output was minimal, with responses typically limited to single words or short phrases, and in response to lower order questions, indicating further opportunities for these teachers to build in higher order questions and activities. Higher order questions necessitate higher order answers which in turn require the use of more complex L2. It seems likely therefore that the issue of L1/L2 use cannot be separated from the overall pedagogical approach that the EMI teacher embarks on. This has important implications for EMI teacher professional development.

6. Conclusions and implications

As the number of EMI programs offered worldwide continues to increase, potential differences in EMI implementation across institutions (e.g. elite and non-elite) should be considered. The EMI programs in this study followed the same model of language support through a preparatory year; however, differences were found across universities and in the classroom-level practices of teachers. The needs and practices of elite universities may be patently different to those of other universities, where student proficiency and teacher experience of teaching through English may be lower. This might limit the feasibility of mimicking practices of elite universities elsewhere in national contexts. The majority of teachers (n=19) included in this study had not received formal pedagogical training of any kind. As such, L1 use and student-centered pedagogies appeared ad hoc, based on teachers' perceptions of effective practices for EMI teaching. Similar findings were reported by Lasagabaster (2017) in Spain, where L1 use by CLIL secondary school teachers was found to be arbitrary or based on teachers' beliefs and intuition. Pedagogical awareness of other ways of conducting EMI classes could potentially be raised via professional development programs. Understanding models of practice helps teacher educators to better understand the current EMI pedagogies in use, allowing them to make more informed decisions about the needs of various teachers. Currently, professional development is rare in EMI contexts, and pre-service training is even rarer (Macaroet al., 2020); nonetheless, the more we can raise awareness of different styles of teaching and strategies that foster interaction, the more we are able to improve EMI delivery across a range of HEIs.

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Table 1: Participating university information

No.	Type & code	Location	Established	Undergraduate Enrolment
1	Small-1	Western	2010 or later	< 3,000
2	Small-2	Western	2010 or later	< 3,000
3	Elite-1	Western	Between 1950-1980	10,000 – 20,000
4	Elite-2	Central	Between 1950-1980	10,000 – 20,000
5	Large-1	Western	Between 1950-1980	40,000+
6	Large-2	Western	Between 1980-2010	40,000+
7	Large-3	Central	Before 1950	40,000+

Table 2: Participating lecturer information

Teacher code	University (no.)	Title	Years Teaching (total)	Years Teaching (EMI)	TMI experience	Gender	PhD	Training
1	Small-1 (1)	Associate Professor	6	2	Yes	Male	Turkey	No
2	Small-1 (1)	Professor	10+	2	Yes	Male	Turkey	No
3	Small-1 (1)	Assistant Professor	1	1	Yes	Male	Switzerland	No
4	Small-2 (2)	Professor	10+	4	Yes	Male	Turkey	No
5	Small-2 (2)	Professor	10+	10+	Yes	Male	Turkey	No
6	Small-2 (2)	Associate Professor	6	6	Yes	Male	USA	Yes
7	Small-2 (2)	Associate Professor	3	3	Yes	Male	Turkey	No
8	Elite-1 (3)	Assistant Professor	10+	10+	No	Female	USA	No
9	Elite-1 (3)	Associate Professor	5	5	No	Male	Switzerland	No
10	Elite-1 (3)	Lecturer	9	9	No	Male	USA	No
11	Elite-2 (4)	Associate Professor	10+	10+	No	Female	USA	No
12	Elite-2 (4)	Assistant Professor	3	3	No	Male	Germany	No
13	Elite-2 (4)	Associate Professor	10+	10+	No	Male	USA	No
14	Large-1 (5)	Associate Professor	3	3	Yes	Male	USA	Yes
15	Large-1 (5)	Assistant Professor	8.5	8.5	Yes	Male	USA	No
16	Large-2 (6)	Professor	10+	4	Yes	Male	USA	No
17	Large-2 (6)	Professor	10+	4	Yes	Male	USA	No
18	Large-3 (7)	Lecturer/ Teaching Fellow	4	4	Yes	Male	Turkey	No
19	Large-3 (7)	Professor	10+	10+	Yes	Male	UK	No
20	Large-3 (7)	Lecturer/ Teaching Fellow	3.5	3.5	Yes	Male	Turkey	No
21	Large-3 (7)	Professor.	10+	10+	Yes	Male	USA	No

Table 3: Turkish use and teacher-student interaction by university type

University type	Turkish use		Interaction	
	Mean (%)	SD	Mean (%)	SD
Small	37.41	34.35	25.94	8.84
Elite	3.79	2.80	11.39	3.12
Large	26.19	31.66	22.99	14.40

Figure 1:

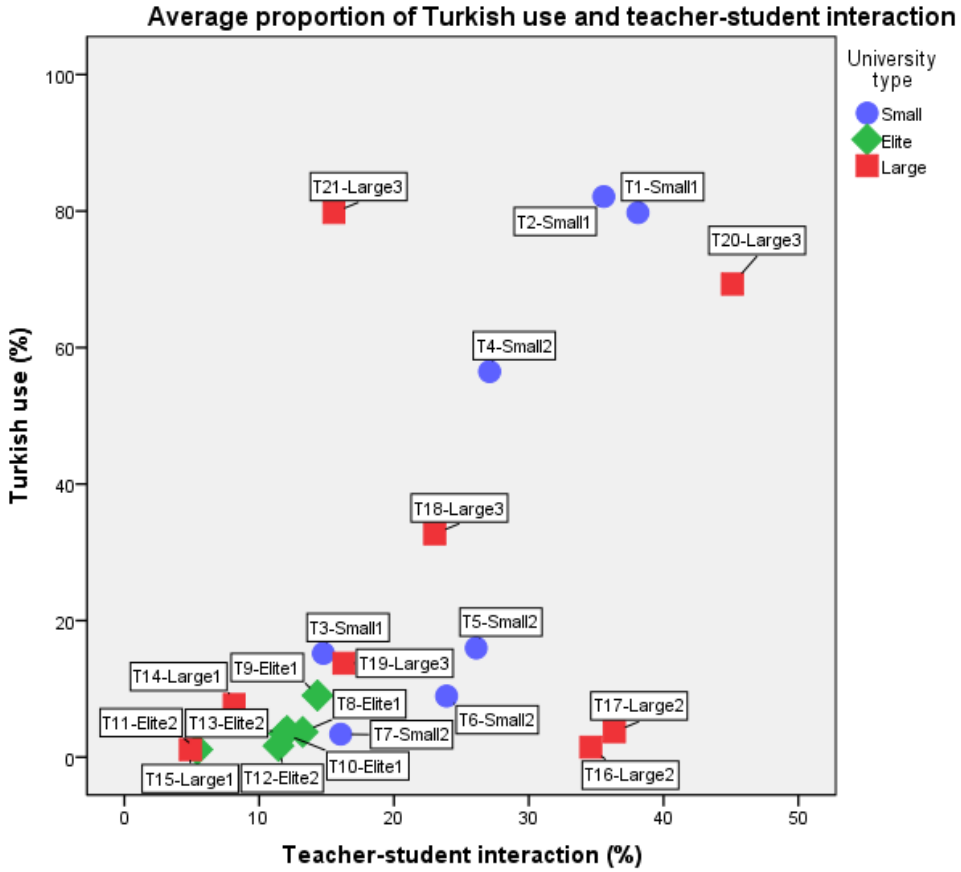
Average proportion of Turkish use and teacher-student interaction
University type
Small
Elite
Large
Turkish use (%)
Teacher-student interaction (%)
0
20
40
60
80
100
0
10
20
30
40
50
T21-Large3
T1-Small1
T2-Small1
T20-Large3
T4-Small2
T18-Large3
T3-Small1
T5-Small2
T19-Large3
T9-Elite1
T14-Large1
T8-Elite1
T6-Small2
T11-Elite2
T13-Elite2
T7-Small2
T17-Large2
T10-Elite1
T15-Large1
T12-Elite2
T16-Large2

Figure 2:

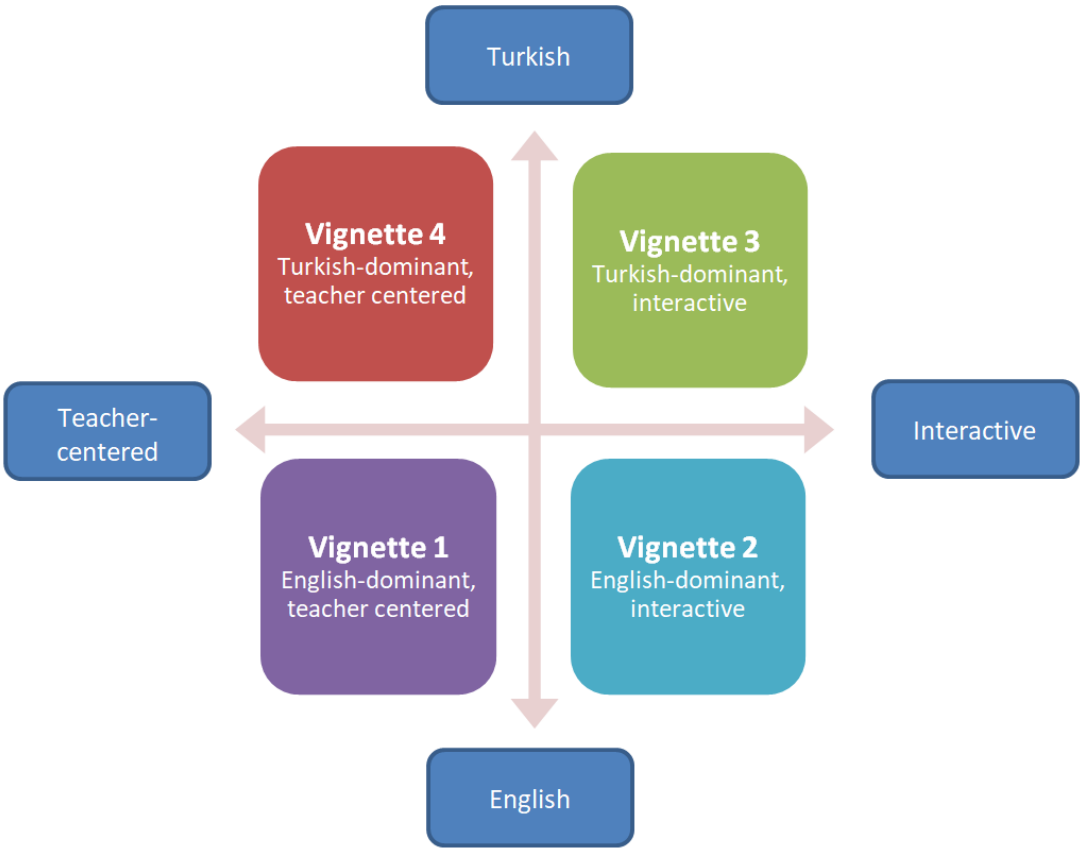

Figure Captions

Figure 1: Proportion of Turkish use and teacher-student interaction in EMI classroom

Figure 2: Variations of EMI implementation

[i] Content and Language Integrated Learning (CLIL) is a dual-focused educational approach with both content and language learning aims.

[ii] Intra-sentential codeswitching involves switching from one language variety to another within a sentence, clause, or phrase. Language use in this study was categorized according to language in a single utterance, or sentence. Inta-sentential codeswitching was recorded as Turkish with English lexical items (T-e) and English with Turkish lexical items (E-t).

[iii] The coding scheme included six categories of language use: pause (0), English (L2), English with Turkish lexical items (E-t), inter-sentential codeswitching (L1/L2), Turkish (L1), and Turkish with English lexical items (T-e).