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Addressing Engineering Students' Needs in EMI Contexts: A Focus on Comprehension and Pronunciation

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Abstract

Effective lecture comprehension in English-Medium Instruction (EMI) contexts is crucial for student learning, particularly when taught by non-native English (NNS) speakers. This study investigates the specific needs of engineering students, emphasizing the impact of lecturers' pronunciation on effective comprehension. Intelligible pronunciation and its relation to comprehension (Munro & Derwing, 1995) are central to this exploration. Students' judgment of NNS lecturers' pronunciation accuracy significantly influences their comprehension (Munro & Derwing, 1995; Valcke & Pavón, 2015). Kornder and Mennen (2021) note that learners' linguistic backgrounds affect their perception of accented speech, which then impacts their evaluation of teaching quality (Jensen, 2013). This study involves a survey of 104 students (both Italian and international), attending MA lectures in engineering taught in English by Italian L1 lecturers. Students were asked to evaluate their lecturers' pronunciation and indicate whether it interfered with their comprehension of the lectures. It also includes assessment of a lecture attended by some of the students surveyed, recorded and transcribed, in order to compare students' subjective impressions of lecturer discourse with objective observations of lecture delivery. Findings reveal that students' perceptions of EMI lecturers' language performance and their comprehension in the classroom are influenced by several

different factors, which affect comprehension regardless of the lecturer's actual English language skills. This study highlights the importance of understanding and addressing the specific needs of engineering students in EMI contexts. By focusing on factors that influence lecture comprehension, we can develop more effective pedagogical strategies and training programs for both EMI lecturers and students.

Keywords: Students' perceptions, Lecturers' speech, Classroom recording, Engineering, EMI

1. Introduction

1.1 Positioning the Study

The growth of English-Medium Instruction (EMI) in higher education, particularly in non-native English-speaking regions, has brought about challenges for both educators and students. As universities adopt EMI programs, balancing subject expertise with effective communication in English becomes crucial. While EMI is seen as a way to internationalize education and offer students global opportunities, language barriers often hinder both teaching and learning, particularly in technical fields like engineering where precise knowledge transfer is critical. Although previous research has explored general language proficiency and instructional clarity, the impact of pronunciation on understanding technical content, especially in engineering, has received little attention. This is an important gap, given the complexity of technical terms and concepts in these fields, which may be further complicated by variations in lecturer pronunciation.

This study examines the intersection of language proficiency and academic content delivery in EMI, with a particular focus on engineering disciplines. Specifically, it aims to address the unique needs of engineering students in these contexts, emphasizing the critical role of pronunciation in facilitating comprehension. As EMI expands, understanding how pronunciation, accent familiarity, and students' linguistic backgrounds affect comprehension is crucial for developing effective language support strategies and enhancing educational outcomes.

This study hypothesizes that the students' comprehension in EMI contexts is influenced by the pronunciation and discourse practices of non-native English-speaking lecturers. It further hypothesizes that this relationship is moderated by students' linguistic backgrounds, levels of English proficiency, and prior experience with English-taught courses. A secondary hypothesis posits that objective measures of lecture comprehension, such as accent familiarity and processing time, correlate with students' subjective evaluations of lecturer intelligibility.

To test these hypotheses, the research employs a mixed-methods approach. First, a survey of 104 engineering students gathers data on their linguistic profiles, experiences with EMI, and subjective evaluations of lecturer pronunciation. In the second phase, an objective analysis of a recorded lecture attended by a subset of these students, correlates their feedback with measurable aspects of the lecturer's delivery. By integrating both subjective and objective data, this study seeks to offer a comprehensive understanding of how lecturer pronunciation affects student comprehension in engineering-focused EMI environments. The findings aim to contribute to ongoing discussions on optimizing EMI delivery, enhancing comprehension,

and improving the overall learning experience for students in technical and engineering programs.

1.2 Literature Review

The widespread adoption of EMI in higher education presents challenges for both lecturers and students. Many universities often prioritize subject expertise over English communication skills (McKinley & Rose, 2022), resulting in lecturers who may excel in their field but struggle with pedagogical communication specific to their discipline (Richter, 2019). This issue is particularly critical in fields like Engineering, where misunderstanding technical instructions can have significant academic and practical consequences, from poor student comprehension to errors in real-world applications. Wächter and Maiworm (2014) identified engineering as a key field for English-Taught Programs (ETPs) in Europe, yet students in this discipline, both foreign and domestic, often have lower English proficiency, highlighting the need to address language and communication challenges in this field.

Research highlights concerns about the English proficiency of EMI lecturers (Picciuolo & Johnson, 2020; Bolton & Kuteeva, 2012; Hellekjær, 2010; Tatzl, 2011), particularly in oral language production aspects like pronunciation, accent, fluency, and intonation (Klaassen & De Graaff, 2001; Ball & Lindsay, 2013). Students often report difficulties in understanding lecturers' accents, which affects their ability to follow lectures (Valcke & Pavón, 2015; Tange, 2010). Even in countries with high English proficiency, such as Norway, research indicates that comprehension in EMI settings is often lower than in native-language instruction due to unfamiliar accents and the cognitive load associated with processing content in a second language (Hellekjær, 2010; Hua, 2019).

Students' linguistic backgrounds also influence their perception of NNS lecturers' speech. Bilingual students (Kornder & Mennen, 2021), or those with prior exposure to English-taught courses (Jensen, 2013) tend to be more tolerant of accented speech. For example, international EMI students were found to be less critical of NNS lecturers, while more experienced students showed greater tolerance and encountered fewer comprehension issues, regardless of their first language (L1) (Clark, 2017). However, Costa and Mair (2022) observed that international students in Italy often struggle more with local accents, whereas Italian L1 students are more forgiving.

The relationship between teacher pronunciation and student comprehension is central to EMI research. Dimova and Kling (2015) noted that students often perceive lecturers with strong accents as less competent, reflecting broader findings in the social psychology of language, where accent variation alone can lead to negative judgements (see, e.g., Giles, 1970; Dalton-Puffer et al., 1997).

However, intelligibility – "the extent to which an utterance is actually understood" (Munro & Derwing, 1995, p. 291) – and accentedness – "how strong the talker's foreign accent is perceived to be" (ibid.) – are partially autonomous variables. Strongly accented speech can still be highly intelligible (Derwing & Munro, 1997) though both dimensions correlate with a third one, i.e. comprehensibility – "listeners' *perception of difficulty* in understanding

particular utterances" (Munro & Derwing, 1995, p. 291; emphasis added).

In this respect, Dragojevic and Giles (2016) argued that negative perceptions towards foreign-accented speech (FAS) are not solely driven by bias against non-standard English, but also from the cognitive effort required to process FAS, which can lead to poorer evaluations. They described this as a consequence of "reduced processing fluency", where speech is judged based on the mental effort required for its processing, highlighting the key role of cognitive effort in shaping listener attitudes. For example, Jensen and Thøgersen (2017) conducted experiments with Danish L1 students to examine how well they understood speakers from different language backgrounds in English. Results showed that accentedness did not affect intelligibility, but harder-to-understand speakers led to longer response times. Furthermore, in complex tasks, more mental effort was needed to understand accented speakers, impacting comprehension. The researchers concluded that accents can impact comprehension when cognitive demands increase.

A further factor influencing the correlation between accentedness, intelligibility and comprehensibility is the so-called interlanguage benefit (Bent & Bradlow, 2003). In their experiment, both NS and NNS participants were asked to listen to text passages read aloud by both NS and NNS of English. The findings showed that NS understood other NS better, but NNS could understand other NNS equally well if they shared the same L1. Despite this, strong empirical evidence supporting the assumption that native speech is inherently easier to understand is still lacking (Richter, 2019).

Moreover, EMI courses generally involve less interactive learning compared to native-language instruction (Lo & Macaro, 2011; Pun & Macaro, 2018; Thøgersen & Airey, 2011), with students struggling in oral presentations and seminar discussions (Kırkgöz, 2009). This reduced interaction can heighten comprehension challenges, making lecture delivery vital for academic success. While teaching involves creativity, cognition, and social interaction – factors extending beyond the teacher's accent – effective lecture comprehension remains crucial for academic success, especially in technical disciplines like engineering, where students face complex content in a foreign language. Understanding these factors is therefore critical to improving EMI learning outcomes.

2. Context of the Study and Method

The university in this study has, over the last ten years, expanded its offer of international degree courses taught in English, with 91 English-taught degree courses in the academic year 2024-25, nearly 40% of the total degree courses on offer. 77 of these are at MA level (53% of a total of 144 MA courses). At the same time there has been little language and/or pedagogical support for the Italian L1 lecturers required to teach these courses in English. Training courses have been organized sporadically and at departmental level, with some departments merely promoting "academic English" training, with voluntary participation by the lecturers. The department featured in this study is somewhat of an exception, in that it has promoted a number of initiatives supporting EMI teacher training. The following study was performed as part of one of these initiatives.

This study draws its findings from two sets of data, bearing in mind that intelligibility is a two-way process involving both the listener and the speaker (Zielinski, 2008, p. 70). The first set concerns the students as receivers of the message. It consists of an online survey designed to gather information about students' perceptions of Italian L1 lecturer speech in the EMI classroom with regard to pronunciation and comprehension, correlated with the demographic information detailed in section 2.1. The second set of data focuses on the producer of the message, in this case the lecturer. As further described in section 2.2, it involves the audio recording and transcription of a lecture attended by just over a third of the students completing the survey, as well as a brief comment on phonological and pronunciation issues with reference to intelligibility on the part of an international audience of diverse origin.

2.1 Online Survey

The 104 student participants in this study were all following MA courses in Engineering in English at this University in central Italy. They included Italian L1 students who chose to follow international courses at home, as well as international students from 29 other language backgrounds.

Three lecturers in an Engineering subject, all Italian L1 speakers, granted permission to the researchers to attend one of their classes during the Spring semester of 2024 and administer an online survey in the last ten minutes of class. No details were available about the lecturers' level of English, nor (with one exception) about their experience with EMI. The link to the survey using Microsoft Forms was made available via QR code to the students present in the lecture hall on those three occasions. 82 students (79% of the total number of students in our study) responded.

Data for an additional 22 students (the remaining 21% in our study) was added from a survey administered by the same researchers in during the Spring semester of 2019. This earlier wide-ranging survey focused on perceptions of Italian L1 lecturer pronunciation and intonation in English from students from both BA and MA courses in both Economics and Engineering (for a summary see Picciuolo & Johnson, 2023, and Johnson & Picciuolo, 2023). While not identical, the questions were comparable with those of the later survey. In order to meet the aims of this present study, only those responses of students studying Engineering at MA level were selected and incorporated for analysis. The lecturers were not the same as those in the later survey. The survey questions were prepared in English. Some required a free response, while others had a pre-set list of possible responses. Students could reply in English or Italian. Besides demographic information in relation to student's L1, age group, self-declared level of English competence on the Common European Framework of Reference (CEFR) for Languages scale, degree course and teaching unit, the survey included questions about the students' evaluations of lecturer pronunciation and comprehensibility in English in order to attempt to investigate the challenges students face and how they cope with these challenges (Sah, 2022, p. 128). Other questions concerned past experience with EMI and English as a vehicular language in general. Finally, more general questions invited free responses in relation to aspects of lecturer discourse impacting lecture efficiency. Responses were correlated with the demographic aspects summarized below.

Just over half of the MA students (55%) were aged between 18-24; 44% were aged between 25-34; just one over 35. Age may affect likelihood of better comprehension in an EMI context (Harley, 2000).

As regards English language level, nine students (8.7%) self-declared native speaker level or C2 on the CEFR scale; 41 (39.4%) were C1; the majority (52: 50%) declared B2. 1.9% (one Chinese and one Turkish student) declared B1 or lower. Since B1+ is considered an absolute minimum for students to benefit from an English-taught course (Bartik et al., 2010), we expect these latter two students in particular to have problems with comprehension.

As regards EMI experience, 31 students (30%) had previously followed an EMI course; while the majority (51: 49%) had not; 22 (21%) gave no response. We expect students with prior EMI experience to have fewer problems with comprehension (Clark, 2017).

Table 1 shows the distribution of students' L1 in broader language groups.

Table 1. Students' L1

Language group	Language	Total no. students
Romance	Italian (34), French, Portuguese, Spanish, Romanian	42
Slavic	Russian, Bosnian	3
Germanic	English (4), German, Norwegian	11
Afro-Asiatic	Arabic, Amharic	6
Indo-Iranian	Farsi, Urdu, Kurdish, Pashto	23
Paleo-Balkan	Albanian	2
Dravidian	Telugu, Tamil	2
Indo-Aryan	Hindi, Nepali, Sinhalese, Kashmiri	4
Turkic	Azerbaijanian, Turkish	5
Sino-Tibetan	Chinese	3
Austronesian	Bahasa Indonesia	1
Bantu	Shona	1
Austroasiatic	Vietnamese	1
Total		104

29 different L1s were spoken by the students in our survey. Only four students claimed to be English L1 speakers. Not unexpectedly, Italian is the L1 shared by the greatest number of students (34), thus making the Romance languages group that of the majority (42). The next largest language group (23 students) is that of Indo-Iranian languages, of which Farsi/Persian is the most represented (15 students). While this may suggest that, if necessary, many students could seek help in understanding from other classmates sharing the same L1, it is also true that 15 students spoke a language that nobody else spoke, and thus such language assistance would not be available.

Our hypothesis (as regards listener focus) was that those students who reported difficulty understanding the lecturers' pronunciation, intonation and accent were also those who 1) had lower English proficiency and/or 2) had less experience studying in English and/or 3) had an L1 which shared no similarities with the lecturer's L1 (Italian) and/or 4) were older.

2.2 Lecture Recording, Transcription and Comment

Permission was asked from the same three lecturers to record their class for research purposes. One lecturer, henceforth Lecturer A, agreed. While no information about Lecturer A's level of English competence was available, we presumed she had at least five years' experience teaching her subject in English, since she had already self-recorded an earlier lecture for inclusion in the EmiBO corpus in 2019 (Johnson & Picciuolo, 2022).

On this more recent occasion, the lecture was recorded via smartphone by one of the researchers sitting in the front row of the lecture hall. The lecture was mid-course, taking place in the 15th week (April 2024) of a 28-week course. The lecture was a typical example of one-way transactional listening (Lynch & Mendelsohn, 2010, p. 182), with some minimal student interaction. The lecture was transcribed immediately after its completion using Whisper (see note 1). The transcription was subsequently checked against the audio file by both researchers and edited where the software had incorrectly deciphered the words. Once transcription was completed, a sample of the recording was analysed by the English native-speaking researcher to identify issues of pronunciation which might present obstacles to comprehension for NNS, and in particular to what extent the lecture included elements of Jenkins' (2000) Lingua Franca Core (LFC). The LFC consists of linguistic features which should be present in order to maximize comprehensibility by non-native speakers of English. These are:

- most consonant sounds
- appropriate consonant cluster simplification
- vowel length distinction
- nuclear stress

(Jenkins, 2000, p. 132)

An extract from the transcript is analysed in section 3.3 with a view to identifying these features.

31 students (30% of the total students in the survey) attended this particular lecture. Unlike the equal balance of ages of the total set, most of the subset (22, 71%) was younger, aged between 18-24 (since this is an MA degree course, we must assume that most were nearer to the upper age limit of 24); nine (29%) were aged between 25-34.

Unlike the total set, which also included native English speakers, none of the subset were NS. In both sets, Italian L1 students were the majority (21, 68% of the subset). While there were also three Norwegian speakers in the subset, just one student spoke each of the other six L1s (Chinese, German, Persian, Spanish, Turkish and Urdu).

Like the total set, most of the subset (19, 61%) declared B2. This was the lowest level in the subset. Eight students (26%) declared C1; four (13%) students declared C2 or native speaker level.

Like the total set, most (21, 68%) had no EMI experience. Of the subset, those with no experience were mainly Italian L1 speakers (18). The L1 of those with previous EMI experience was Chinese (one), German (one), Italian (three), Norwegian (three), Spanish (one), and Turkish (one).

The responses of these students to the survey were extracted and compared in relation also to the analysis of the recording, in order to cross-check whether those who had little difficulty understanding the pronunciation of one particular lecturer were assisted 1) by sharing the same L1 as the lecturer (Italian) or at least speaking another Romance language, and/or 2) by the extent to which LFC features were used by Lecturer A herself, thus facilitating universal comprehension by students from vastly different L1s.

3. Results

3.1 Survey Results for All 104 Students

The graph in Figure 1 shows responses to the question *During class, was it difficult for you to understand the lecturer because of their pronunciation?*

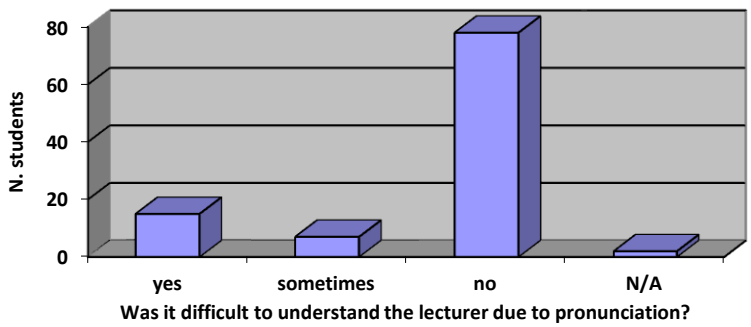

Figure 1. Difficulty understanding lecturer due to pronunciation

The great majority of students (78: 75%) found that the lecturer's pronunciation did not hinder comprehension, while 22 (21%) found it difficult or sometimes difficult to understand the lecturer due to their pronunciation. Figure 2 refers to those 22 who had difficulty with

regard to their level of English. As expected, 100% (two) of the lowest level students (<B1) had difficulty.

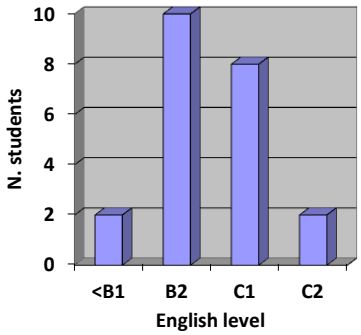

Figure 2. English level of students who had difficulty understanding lecturer due to pronunciation

However, on average, 20% of the B2, C1 and C2 students also had difficulty. This suggests that a lower level of English is not the only factor in predicting difficulty.

As regards age (Figure 3), difficulty in understanding was claimed by 16% (nine) of the younger group, but by 28% (13) of the older group.

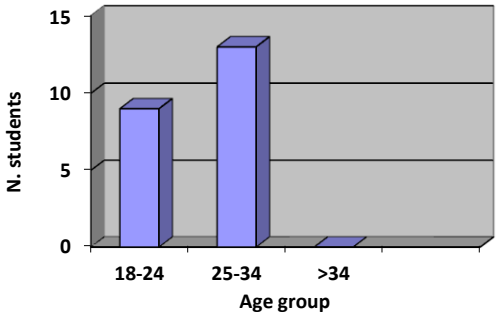

Figure 3. Age of students with difficulty understanding lecturer due to pronunciation

This suggests that being older is a predictor of difficulty in comprehension.

As regards L1, the 22 students who claimed their understanding was hampered by lecturer pronunciation unexpectedly included Romance language speakers, and even seven Italians (21% of the Italians present: of whom four were older and had no EMI experience). Given that the lecturers' L1 was Italian, this suggests that any interlanguage benefit was outweighed by being older and having no EMI experience.

Figure 4 shows the percentage of students from each language group who had difficulty due to pronunciation.

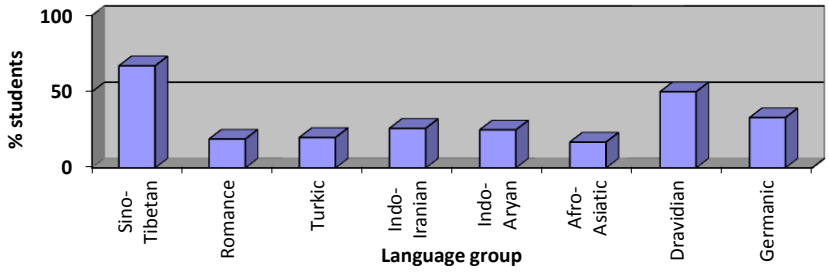

Figure 4. L1 of students who had difficulty understanding lecturer due to pronunciation

Numbers are small but it is worth noting that two out of the three Chinese (Sino-Tibetan) speakers as well as one of the two Dravidian language speakers (Telugo) had problems with comprehension. The level of English of these students ranged from <B1 through B2 and C1 so language level is not a predictor, but the two Chinese speakers were also in the older age group, suggesting that age is a factor. The Turkish speaker with comprehension problems was in the older age group and also had a very low English level (<B1). Of the two students who spoke Germanic languages and had comprehension problems, one student of Pakistani origin declared L1 English. Despite having native speaker proficiency, s/he was evidently accustomed to a different accent.

As regards to what extent experience with EMI alone is related to comprehension difficulties, Figure 5 shows that many students who had problems with comprehension had no prior EMI experience.

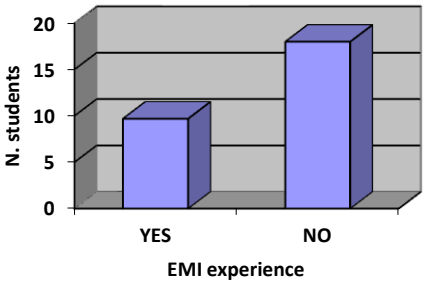

Figure 5. Experience with EMI of students with difficulty understanding lecturer due to pronunciation

However three students (9.7% of 31) with EMI experience did instead find comprehension difficult. Two of these were in the older age group. Instead, nine students (18% of 51) without EMI experience found it difficult. This suggests that EMI experience makes it easier to overcome difficulties understanding pronunciation.

So low English level, being aged 25-34, and with no EMI experience is a predictor of difficulties related to comprehension because of lecturer pronunciation. 79% of the Italian students present claimed they had no difficulty understanding the pronunciation of the Italian L1 lecturer. This could be due to the interlanguage benefit, although 21% of the Italians did

have difficulty. Only one of the Italians with difficulty however had experience with EMI and four of these were older students.

Comments relative to comprehension by students with higher levels of English competence included the following:

1. *"Most italian professors do not have a clearer english pronunciation. I usually tend to skip a lot of words they say"*. [English/Pakistan: C1]
2. Pronunciation and intonation interfere with understanding "*because my english is better than most of the professor's english. It's tricky to understand wierd english and try to learn the actual course material at the same time".* [Norwegian: C2]
3. *"I usually understand what the teachers say, except for one or two professors who could have more practice in the talking part and the right use of some words, not using literal translation".* [Portuguese: C1]
4. *"There are some words in which I was confused earlier like wal-king (walking), hhaours(hours). There is some pronunciation difference otherwise its ok".* [Urdu: C1]
5. "*Sometimes pronunciation interferes with understanding but I am comfortable following courses in English because the level of the language is very simple"*. [Italian: B2]

Written comments are often difficult to interpret. Comments (2) and (3) possibly show reference to a need to develop both lecturers' and students' technical lexis. They also suggest (Comment 1) that content learning might be negatively affected by lack of understanding. There is implied reference to the benefit of acquired familiarity (Comment 4: *some words in which I was confused earlier*). The 'simple' level of language in Comment (5) is unclear. The student might be referring to syntax, but s/he could also mean that the lecturer is repetitive, or uses non-expert terminology to explain technical issues. Evidence of both these elements emerged from the transcript of Lecturer A's lecture. While Comment (3) about using literal translation could refer to the inventive use of calques from the Italian (e.g. Lecturer A: "*so not to alter the numeration of the successive slides*", where both 'numeration' and 'successive' are non-standard calques based on the Italian *numerazione* and *successive*), it could also refer to the literal translation of idiomatic phrases in Italian, which would be unclear to speakers of other languages.

Students were asked to specify the improvements that lecturers could make to improve lecture efficiency. The 22 students in the earlier survey had a drop-down menu to select lecturer language skills that required improvement. The majority selected pronunciation and speaking as areas to improve. The 82 students of the later survey had a free response to this question. Suggestions did not so much concern language skills as more general pedagogical aspects and discourse practices, which research has found to be at least as important as language competence (Klaassen, 2001). These included:

- giving more examples from the real world;

- repeating the basic concepts;
- other classroom activities (quizzes, practical work);
- recording the lecture and making it available;
- enhanced lecture delivery and time management (e.g. *Not rushing to cover more content but also explain less and better).* This approach aligns with Hincks' (2010, p.5) best-case scenario of a more concisely delivered L2 lecture.

Students' suggestions make it clear that any lack of comprehension due to lecturer pronunciation could be compensated by the use of repetition, providing lecture recordings for students to watch again, and classroom activities other than monologic lecturing. In this way, more opportunities are given to engage with other students and seek clarification where necessary, at the same time improving lecture delivery. This suggests that pre-preparation and practice on the part of the lecturer is even more essential when delivering a lecture in an L2.

So far we have considered the survey results for the whole sample. We now focus only on the results for those students who followed Lecturer A's class, for which the lecture was recorded and transcribed.

3.2 Survey Results for Lecturer A's Students Only

While 75% of the total set had no trouble understanding the lecturer's pronunciation, this figure rose to 90% of the subset. Of this subset, just three (10%) did find lecturer pronunciation an impediment. Of these three, all were B2 English level and all were slightly older (25-34). Their L1 was Chinese (one) or Italian (two). The Chinese speaker had EMI experience while the Italian speakers did not.

To conclude, though the number of students with comprehension difficulty in the subset is small (three), they share the combination of being older and having a lower level of English, while lack of prior EMI experience appears to override any interlanguage benefit in the case of the Italian L1 speakers.

Section 3.3 focuses on the lecture attended by the students described in section 3.1 in order to compare their perceptions with an objective analysis of the lecture discourse.

3.3 The Recording of Lecturer A's Cass

Lecturer A's class was recorded in the middle of a 28-week course. This placing suggests that students will have gained some familiarity with the lecturer's pronunciation and teaching style. Both pronunciation and speech rate are factors in lecture comprehension (Matsuura et al., 2014.)

As regards speech rate, the transcript consisted of 6,678 words (student contribution was minimal, and generally occurring after recall questions asked by the lecturer (*"what temperature will we have here ….?")* distributed over 80 minutes, with few pauses between chunks of speech. A rough calculation of the speech rate amounts to 83.5 words per minute. The average rate for native speaker lecture discourse is 125-160 words per minute (Tauroza

& Allison, 1990; Nesi, 2001), while below 100 words per minute is considered 'slower than normal'. Lecturer A's speech rate may thus easily be classed as much slower than normal. Why this was so is not clear. It might be due to the cognitive demands of using her L2 (Hincks 2010), but also to the fact that she was commenting a presentation and also writing on the whiteboard at the same time. The role of speech rate in lecture comprehension remains unclear (Crawford Camiciottoli, 2005), with some contradictory findings. While Zhao (1997) found that slower delivery rates led to better comprehension in general – though much depended on students' own internal perception of speech rate – L2 listeners are said to prefer slower lecture delivery but at the same time do not necessarily benefit from relatively slow deliveries (Derwing & Munro, 2001), in the sense that their learning is not always enhanced by the slower speed.

As regards pronunciation, a sample of the transcript selected at random from the 13th minute was rendered in phonetic script, shown in the right-hand column of Table 2. The elements in bold are commented below:

Table 2. Transcript and phonetic rendering of lecture extract

Instantaneous release of **masses**, continuous **release** flow rates, but the physical phenomenon is exactly the same. Okay, so what **temperature** will we have here? Minus 42. When you put your **spray** on the body, on your body, you feel the cold **temperature** even in **summer**, okay? This is the **flash**. Okay, so guys, we can **again** define the fraction of **vaporization** or degree of **vaporization**, the fraction of **rainout** or degree of **rainout**, and the fraction of entrainment or degree of entrainment. But in this case, we will have not the **ratio** of two **masses**, okay, instead we will have the **ratio** of **outflow rates**. […..]	**ɪnstənˈtaːniəs rɪˈliːz** ɒv ˈ**mæsɪzə**, kənˈtɪnjuəs **rɪˈliːz** fləʊ reɪts, bʌt ðə ˈfɪzɪkᵊl fəˈnɒmɪnən ɪz ɪgˈzæktli ðə seɪm. ˌəʊˈkeɪ, səʊ wɒt ˈ**tɛmpɛrətʃʊr** wɪl wiː hæv hɪə? ˈmaɪnəs 42. wɛn juː pʊt jɔː **spraɪ** ɒn ðə ˈbɒdi, ɒn jɔː ˈbɒdi, juː fiːl ðə kəʊld ˈ**tɛmpɛrətʃʊr** ˈiːvᵊn ɪn ˈsʌmər, ˌəʊˈkeɪ? ðɪs ɪz ðə **flæʃə**. ˌəʊˈkeɪ, səʊ gaɪz, wiː kæn **əˈgeɪn** dɪˈfaɪn ðə ˈfrækʃᵊn ɒv ˌ**væpɔːraɪˈzeɪʃᵊn** ɔː dɪˈgriː ɒv ˌ**væpɔːraɪˈzeɪʃᵊn**, ðə ˈfrækʃᵊn ɒv **reɪn aʊt** ɔː dɪˈgriː ɒv **reɪn aʊt**, ænd ðə ˈfrækʃᵊn ɒv ɪnˈtreɪnmənt ɔː dɪˈgriː ɒv ɪnˈtreɪnmənt. bʌt ɪn ðɪs keɪs, wiː wɪl hæv nɒt ðə ˈ**ræʃɪəʊ** ɒv tuː ˈ**mæsɪzə**, ˌəʊˈkeɪ, ɪnˈstɛd wiː wɪl hæv ðə ˈ**ræʃɪəʊ** ɒv ˈ**aʊtfləʊ reɪtsə** .[….]
I don't refer to water because we need to talk about **hazardous** substances. Okay, so first example water, but then we have to consider the **hazardous** substance.	aɪ dəʊnt rɪˈfɜː tuː ˈwɔːtə bɪˈkɒz wiː niːd tuː tɔːk əˈbaʊt **hæz'aːrdəs** ˈsʌbstᵊnsɪz. ˌəʊˈkeɪ, səʊ fɜːst ɪgˈzɑːmpᵊl ˈwɔːtə, bʌt ðɛn wiː hæv tuː kənˈsɪdə ðə **hæz'aːrdəs** ˈsʌbstᵊns.

Pronunciation issues typical of Italian L1 speakers were found (Wheelock, 2016) and are highlighted in bold in Table 2. They included the following:

- addition of the *schwa* sound between and at the end of words, e.g. *masses:* /ˈmæsɪzə/, *rates:* /reɪtsə/;
- lack of differentiation between stressed and weak syllables, e.g. *temperature*: /ˈtɛmpɛrətʃʊr/;

- non-standard syllable stress: e.g. *hazardous:* /hæzˈa:rdəs/;
- non-standard pitch movement, e.g. *degree of rainout;*
- substitution of /z/ for /s/ e.g. *release:* /rɪˈli:z/;
- certain vowels lengthened or mispronounced: e.g. *spray*: /spraɪ/, *vaporization:* /ˌvæpɔ:raɪˈzeɪʃᵊn/, *instantaneous:* /ɪnstənˈta:niəs/, *temperature:* /ˈtɛmpɛrəʧʊr/;
- absence of suprasegmental features such as contrastive stress, e.g. (*degree*, or on *outflow* in the following): wi: wɪl hæv nɒt ðə ˈræʃiəʊ ɒv tu: ˈmæsɪzə, ˌəʊˈkeɪ, ɪnˈstɛd wi: wɪl hæv ðə ˈræʃiəʊ ɒv ˈaʊtfləʊ reɪts.

The use of adequate pronunciation has a noticeable impact on the transmission of content in academic lectures (Valcke & Pavón, 2015 p. 327). More specifically, improper use of accentuation and intonation is a major cause of errors in comprehension (ibid. p. 326). In English, the stressed syllable becomes the basis for word recognition (ibid.). In this way *hazardous* with stress on the second syllable, rather than the first one, makes it hard for students to immediately recognize the word. However, this will not be the first time this lecturer has pronounced the word, since the topic of the course itself is largely 'hazardous substances'. It is therefore unlikely to hinder comprehension at this stage in the course, due to familiarity and possibly also because it appeared in written form on the slide.

While a number of non-standard pronunciation features were found even in this short sample, as listed above, the much slower speech rate, as well as the degree of repetition (in this extract, in the real-world example: *on the body, on your body*), might be another reason why 90% of students found Lecturer A's pronunciation did not hamper understanding (Valcke & Pavón, 2015 p. 334). In addition, the researcher present at the lecture noted that the slides featuring text and equations were provided for students as handouts before the lecture. As examples of visual support and mathematic demonstrations, these additional tools aid student comprehension (Valcke & Pavón, 2015).

What is more, Lecturer A's pronunciation might be easier to follow because it displays features of LFC, essential for comprehensibility by NNS. Indeed, in line with LFC features:

- Lecturer A's speech preserves most consonant sounds;
- Lecturer A uses appropriate consonant cluster simplification, preserving consonant clusters at the beginning and middle of words and where grammatically important (e.g. verb suffix *-ed*);
- While the exact quality of vowel sounds is not important for LFC (and thus we may discount the mispronounced *spray:* /spraɪ/), Lecturer A does distinguish vowel lengths;
- Lecturer A generally uses correct nuclear stress, crucial for intelligibility in English as an International Language (Jenkins, 2000, p. 153) whether marked or unmarked, since it highlights the most salient part of the information and shows where listeners should pay most attention. While stress-timing is not a feature of LFC, the lengthening of stressed (nuclear) syllables is crucial to intelligible English pronunciation. However

contrastive stress is also important, and in this extract Lecturer A does not use contrastive stress correctly (*outflow, degree*).

We may conclude that in general, however, most features of the LFC, synonymous with greater comprehensibility for NNS listeners, are present in Lecturer A's speech.

4. Discussion

This study examines the evolving nature of EMI at university level, with a specific focus on the Italian context and the engineering discipline, where international degree programs taught in English have seen substantial growth. Despite this expansion, a significant gap persists in providing adequate language and pedagogical support for both lecturers and students. Factors such as language proficiency, prior EMI experience, and linguistic backgrounds are crucial in shaping student comprehension in these settings.

Survey data revealed that while most students reported minimal difficulty in understanding lecturers' pronunciation, specific subgroups – especially those with lower English proficiency and limited EMI experience – struggled more. These findings align with previous studies, which indicate that listeners' attitudes towards language variation in spoken interactions influence both intelligibility and comprehensibility. Listeners who are more familiar with accent variations tend to decode speech more easily, experience a lower cognitive load, and, as a result, feel more confident when interacting with individuals who speak English as a second language (Derwing et al., 2002; Fraser, 2011). Additionally, older students (aged 25-34) reported more challenges than younger ones, suggesting that the latter, despite having less experience, may be better linguistically prepared or more adaptable to EMI contexts. While previous studies have not specifically focused on age-related variations among EMI students, we have noted that Clark (2017) found that second-year students, regardless of their L1, experienced fewer comprehension issues with NNS lecturers. Therefore, our conclusions regarding the impact of age should be approached with caution, particularly since the sample size for older students was relatively small.

The detailed analysis of Lecturer A's recorded lecture provides further insights into the factors that support effective intelligibility, even in the absence of significant pronunciation challenges. Despite some non-standard pronunciation features typical of Italian L1 speakers, Lecturer A's slow speech rate, discourse practices (like repetition, concept consolidation, and questioning), and alignment with LFC features, all contributed positively to intelligibility. Pedagogical strategies such as providing materials in advance and using real-world examples further mitigated potential comprehension challenges. In this regard, as Pagèze and Lasagabaster (2018, p. 302) argue, it is important to shift "from framing EMI as a language problem to framing it as a specific disciplinary communication context", where "teachers willing to teach their subject in English should focus on both language and content, and on the pedagogical specificities of combining the two" (Henderson, 2019, p. 1).

In contrast to Valcke and Pavón's (2015) study on homogenous L1 groups, this study featured students from 29 different L1s and 13 language groups. Despite this diversity, 75% of students overall and 90% of those in a specific subset had little difficulty understanding the

lecturer. Among those who struggled, the key predictors were lower English proficiency, lack of prior EMI experience, and older age. While linguistic distance from the lecturer's L1 (Italian) did impact comprehension, the anticipated "interlanguage benefit" for students sharing a Romance language background with the lecturer was not consistently observed. Interestingly, some Italian and Romance language L1 students also reported difficulties, indicating that factors like familiarity with specific native or non-native Englishes, as well as specific teaching styles may play a more critical role. This aligns with findings from previous studies (see, e.g., Ghobain, 2016) which suggest that intelligibility is not necessarily dependent on listeners and speakers sharing the same native language or accent. In Ghobain's (2016) study, participants reported finding some specific non-native varieties of English more intelligible than others, while certain non-native Englishes were less intelligible. This suggests that intelligibility is more likely influenced by familiarity with different English variations, which can be gained through exposure to various forms of spoken English.

Phonetic transcription and analysis of Lecturer A's lecture also provided objective insights into students' perceptions of pronunciation. While students from non-Romance language backgrounds might have been expected to face more challenges, intelligibility levels among this subgroup remained high. The lecturer's consistent use of LFC features, along with a slower speech rate, pre-prepared materials, and discourse strategies such as repetition, paraphrasing, and interactive questioning, likely contributed to overall intelligibility by giving students more processing time and reinforcing key concepts. This is particularly relevant for engineering students, whose cognitive load is influenced both by the need to acquire new scientific knowledge, which results in higher lexical density (see, e.g., Dang, 2018), and by their proficiency in English. Although a strong vocabulary has been found to enhance listening comprehension (see, e.g., Dang, 2018), variations in lecturers' spoken output may still hinder students' intelligibility, and it has been noted (Martin-Rubió & Diert-Botié, 2023) that STEM lecturers need greater practice with the pronunciation of specialised terms than social sciences lecturers.

Ultimately, this study underscores the complex interplay of linguistic, pedagogical, and experiential factors in determining student success in EMI contexts, particularly within linguistically diverse classrooms.

5. Conclusion

The findings of this study highlight the multifaceted challenges of teaching and learning in EMI contexts, where lecturer pronunciation, student English proficiency, and pedagogical strategies converge to impact comprehension. While overall comprehension levels were high, the research underscores the need for targeted language and pedagogical support that addresses the specific challenges faced by students, particularly those with lower English proficiency and limited EMI experience who may be more susceptible to comprehension difficulties.

One of the key takeaways is the critical importance of preparing students for EMI courses. Beyond language proficiency, students need exposure to the academic and cognitive demands of understanding lectures in L2 English varieties. EMI programs should incorporate

pre-course language support, familiarization with the specific discourse practices of academic English, and training in strategies to manage lectures delivered in an L2. This preparation is especially vital for students with limited EMI experience or lower English proficiency, who are more likely to struggle even in courses taught by lecturers with clear and intelligible pronunciation.

Equally important is the role of lecturers in adopting teaching strategies that accommodate a linguistically diverse student body. In line with current trends in EMI lecturer training (Pagèze & Lasagabaster, 2018), this study emphasizes the importance of equipping lecturers with both language and pedagogical skills to effectively combine subject content with English as the medium of instruction. Effective EMI teaching should not only focus on clear pronunciation but also on allowing listeners more processing time through careful speech pacing, as well as reducing students' cognitive load with visual aids and interactive strategies like repetition and paraphrasing. Providing lecture materials in advance and contextualizing difficult concepts with real-world examples can also significantly enhance student comprehension.

As such, this study further supports the claim that "EMI is an opportunity to focus on the two-way nature of interaction, as the guiding principle for classroom exchanges, teacher support and training for speakers and listeners" (Henderson, 2019, p. 9). Building on this, the study highlights that, while lecturer proficiency is crucial, student success in EMI environments depends equally on the preparation and support they receive. Therefore, institutions must adopt a dual approach: enhancing lecturer capabilities, while equipping students with the necessary tools and strategies to thrive in an academic environment where English is not their first language.

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Note

Note 1. Whisper is a transcription software operating in a Python environment available from https://whisperui.com.

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