

# Rethinking language teaching for engineering students

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## **Abstract**

*In today's globalized world, foreign languages, particularly English, have become imperative for engineers. However, traditional language classes, even specialized technical classes, often lack the opportunity for students to practice and acquire the necessary linguistic skills for their professional lives. These skills include the ability to extract information from technical texts, communicate with co-workers of different native languages and varying competencies in the foreign language, and express technical concepts in an understandable way. Changing the approach of technical English classes to a more practical and hands-on method, while also providing tandem language learning tailored to the needs of engineers by pairing students from the same or related academic disciplines, has been shown to significantly improve students' writing and speaking abilities. Additionally, students feel more confident using the foreign language in a work environment.*

**Keywords:** *foreign language education; engineering education; tandem language learning, technical English*

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## **1. Introduction**

In the rapidly evolving landscape of modern engineering, the ability to communicate effectively across borders and cultures has become an increasingly valuable skill for professionals. As the world becomes more interconnected, engineers are finding themselves collaborating on international projects, participating in global teams, and engaging with a diverse range of stakeholders. In this context, proficiency in foreign languages has emerged as a critical asset for engineers (Johri & Jesiek, 2014). Learning foreign languages and improving language skills have therefore become an important addition to subject-specific engineering courses at university.

Universities still predominantly prioritize traditional language classes as the primary method for imparting language skills to engineering students. These classes typically follow established curricula, emphasizing grammar, vocabulary, and general language proficiency. While these

foundational language courses provide a structured approach to learning, there is a growing recognition of the need for more practical and context-specific language training including intercultural competences tailored to the demands of the engineering profession (Rus, 2020). The prevailing emphasis on regular language classes may not fully address the nuanced communication challenges that engineers encounter in a globalized work setting. As the engineering field continues to evolve and emphasize international collaboration, there is a growing call for innovative approaches, such as tandem language learning and specialized engineering communication courses, to complement traditional language education and better prepare students for the complexities of cross-cultural communication in their future professional endeavors. In response to this need, a language teaching concept has been developed to cater to the needs and interests of students. This approach integrates traditional language teaching methods with innovative approaches, resulting in a significant improvement in participants' linguistic proficiency in both written and spoken communication.

## **2. Problem statement: current situation and challenges**

Engineering students, aspiring to thrive in a globalized industry, must recognize the importance of linguistic competence, especially in English. Beyond the technical aspects of their discipline, the ability to articulate ideas, convey technical concepts, and understand diverse perspectives in a foreign language can significantly enhance an engineer's effectiveness and career prospects. In addition to English, any further language will make it easier for them to collaborate on an international stage.

In a globalized work setting, engineers face significant challenges. English is often used as the predominant language for international communication, serving as a lingua franca. While this facilitates collaboration among professionals from diverse linguistic backgrounds, it also presents the challenge of effective communication. This pertains to situations where non-native speakers are the majority or where there is communication between native and non-native speakers, resulting in an imbalance. Technical discussions and the expression of complex engineering concepts may be challenging for those who are not fully proficient in English, which can lead to misunderstandings or misinterpretations. The differing linguistic abilities of communication partners can be a significant obstacle. Engineers frequently interact with colleagues, clients, and stakeholders who have varying levels of proficiency in the common language, whether it is English or another lingua franca. This diversity in linguistic skills can affect the clarity and efficiency of communication, requiring engineers to adapt their communication styles, use simpler language when necessary, and employ effective strategies to ensure that technical information is accurately conveyed. In today's globalized work environment, successful collaboration and project outcomes depend on bridging the gap between individuals with different linguistic capabilities.

Traditionally, language education has followed a structured approach primarily centered around classroom instruction. Students engage in language classes where they are exposed to grammatical rules, vocabulary, and can practice listening comprehension and speaking only in a restricted manner. These classes typically involve a combination of lectures, textbooks, written exercises, and oral assessments. The emphasis is often placed on foundational elements such as pronunciation, grammar, and syntax. Additionally, traditional language teaching often incorporates cultural elements to provide students with a broader understanding of the language context, but intercultural communication is missing. While these methods have been the bedrock of language education for decades (Ur, 2013), there is a growing recognition of the need for more dynamic, authentic and practical approaches (Renau Renau, 2016; Spänkuch, Dittmann et al. 2019; Ur, 2013), particularly in professional fields like engineering, where precise communication skills and context-specific language use are crucial.

A major weakness of traditional language classes is the time allocated to each student for speaking exercises, a skill that is particularly important for future engineers (Salzinger, Schiffmann et al. 2022). To them, mastering the language to near perfection is less important than finding ways to express themselves successfully in a professional setting and adapting their language skills to the given situation. They need to be able to break down and express complex aspects in easy language, deploying the language skills they have, while adapting to their conversation partner. To cultivate a strong linguistic foundation, a combination of structured language classes with an additional focus on subject-specific discussions and problem-solving, and tandem language learning is considered ideal. Traditional language classes provide essential grammar, vocabulary, and foundational skills. However, tandem language learning, which involves pairing individuals with different native languages to practice conversational skills, offers a practical and immersive experience that cannot be replicated in a classroom setting alone. In addition, both partners will acquire much more intercultural competencies in direct interaction with a native speaker of their target language.

### **3. Revised approach**

Although the university provides general foreign language courses in various languages, the Department of Civil and Environmental Engineering at the Ruhr-Universität Bochum, Germany offers two specialized courses in technical English for civil engineering to overcome the above-mentioned problems of traditional foreign language teaching. Each course consists of four hours of instruction, two of which are conducted asynchronously on Moodle. This allows for individualized grammar review, reading comprehension, writing exercises and practice at the student's own pace and to the necessary extent online. The time in class can be used to focus on relevant tasks that will occur in a professional setting, limiting grammar exercises to the most frequent problems. Technical English I (TE I) emphasizes reading subject-specific texts, extracting crucial information, and discussing the content. The required language level is

approximately B1. The texts serve as a basis for discussions in which students can apply their engineering knowledge to the foreign language. The primary objective is to help students feel confident discussing topics for which they may lack vocabulary. For further support, pro/con discussions are introduced, where students defend their own point of view and attempt to convince others of their position. Additionally, language games such as Taboo, which utilize engineering-related vocabulary, are played. Finally, towards the end of the semester, students participate in role plays where they embody different individuals working on a construction site. Students are presented with realistic problem scenarios that they must solve using the vocabulary they have acquired through the texts and language games, as well as the discussion skills gained from pro/con discussions. The class concludes with a written test covering grammar, translations, and a short, written discussion.

Technical English II (TE II) provides students with advanced and less guided discussions and role plays, along with an introduction to academic work in English. The required level at the beginning is B2. The course aims to equip students with the skills required to communicate effectively in academic and professional settings. The first half of the semester is dedicated to work-related discussions, including for example the evaluation of various materials, their strengths and weaknesses, and their suitability for constructing different structures with consideration for sustainability. Since the class is open to all engineering student regardless of their native tongue, this also allows them to interact with speakers from different cultural and linguistic backgrounds and different competencies in the language. The latter half of the course focuses on developing writing and presentation skills, which are demonstrated at the end by presenting group projects that the students have been working on throughout the semester. The project must be written in the form of a scientific paper afterward.

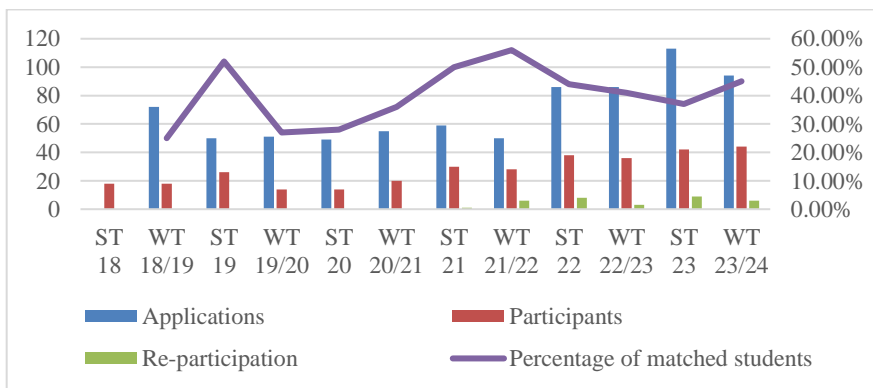
In addition to language classes, a STEM-specific tandem program is offered that pairs STEM students (Science, Technology, Engineering, and Mathematics) who want to improve their language skills. In a language tandem, two students are paired to help each other improve in their respective languages. They learn the language of their partner and provide assistance in return. Tandem.MINT is a unique program aimed only at STEM students because they often have different needs and interests when learning a language (Salzinger et al., 2022). STEM disciplines, which are often characterized by technical complexity and specialized terminology, benefit from a tandem system. In this setting, STEM students can leverage their shared expertise to delve into subject-specific language challenges and enhance their communication skills in a context directly relevant to their field. The tandem approach enables the examination of technical terminology, scientific discourse, and engineering communication techniques in a cooperative and pragmatic manner. This not only facilitates language acquisition but also promotes interdisciplinary and intercultural collaboration, preparing STEM students for effective communication in diverse and globalized professional settings. To receive credit points for the tandem program, students are required to compile a portfolio that served as a basis for

evaluating their grammar and writing skills. At the outset, the students need to put their overall tandem goal in writing and continuously reflect on their progress by writing detailed reflections of representative sessions throughout the semester.

#### 4. Methodology

To observe and evaluate improvements, all writing assignments from the classes and the tandem, grammar tests and audio reflections were collected and reviewed. In addition, a self-assessment and an assessment of the tandem partner were conducted before and after the tandem program and analyzed.

The Technical English classes typically have around 30 participants, while the tandem program has been steadily growing and now has between 34 to 44 participants per semester. The tandem is open to all language combinations, but the main focus in this study has been on German-English pairs, with an emphasis on German speaking students who are eligible for the English classes. The English classes have only been offered within the last three terms, so only seven students have participated and completed all three components while three more have completed TE I and are participating in the tandem at the moment. However, the tandem program has been in place for five years already with increasing participation (Fig.1). Therefore, all written components and assessments have been considered since the winter term of 2020/21 for English, providing us with data from 64 German students who are learning English, seven of which could be evaluated in more detail based on their class assignments, test, and scientific paper.

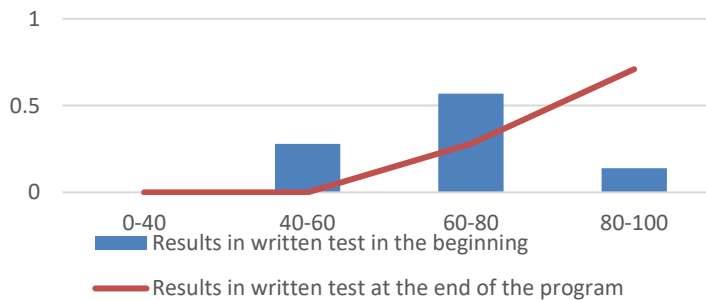


*Figure 1: Tandem applications and participation*

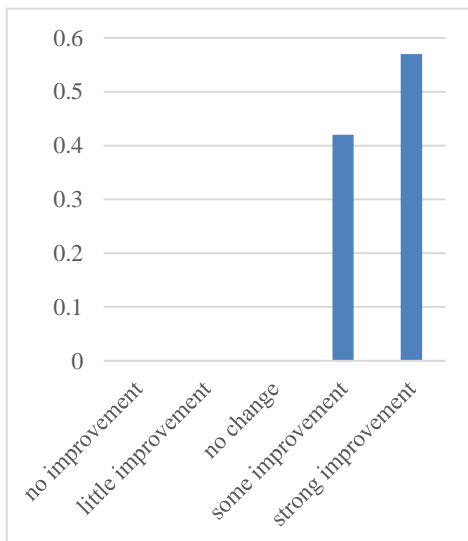
#### 5. Findings and Discussion

According to the students' self-evaluation, they have improved in their desired area of written or spoken communication (fig. 3). Upon analysis of their written texts, work samples, reflections, and their written tests (fig. 2), this claim is supported by evidence: their texts contain

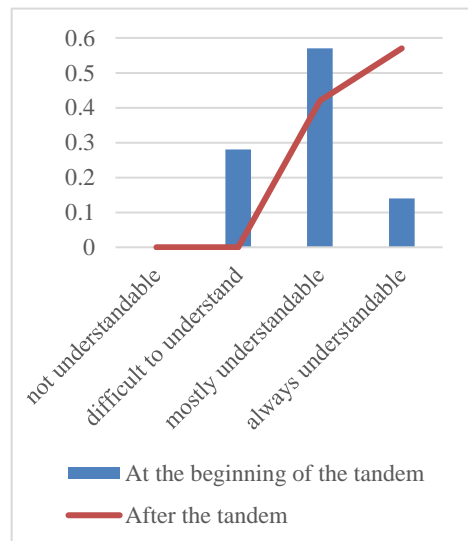
fewer errors, more complex sentences, and a wider range of vocabulary. The initial general paraphrasing of subject-specific aspects has been replaced with specific technical vocabulary, resulting in a more precise expression of scientific and technical contexts. Our American partner university requires oral presentations, which provide us with a good opportunity to observe oral competencies and improvements. The students' pronunciation, fluency, and accuracy showed significant improvement, which was corroborated by their German tandem partners (fig. 4). The students spoke more clearly, their accent became less pronounced, and they hesitated and corrected themselves less frequently than in the beginning.



*Figure 2: Improvement in written tests*



*Figure 3: Self-assessment*



*Figure 4: Assessment by the tandem partner*

Students in class as well as in the tandem also confirmed that they feel more comfortable and confident speaking. But particularly in the tandem, students said that it helped immensely that they could practice speaking in such an intimate frame. Many of them expressed their fear of speaking beforehand, claiming that they were afraid of making mistakes and not being able to express technical concepts. Because both partners were in the same situation, having to use a foreign language to communicate, it becomes easier to overcome inhibitions. All students confirmed that even without always knowing and finding the exact terminology, they felt able to express what they wanted to communicate.

## **6. Conclusion**

The imperative for engineers to speak foreign languages is undeniable in today's globalized engineering landscape. Recognizing this need, engineering education should encompass not only technical proficiency but also a commitment to linguistic diversity. The integration of language classes that follow a more hands-on method in combination with tandem language learning provides a comprehensive approach to language acquisition, preparing engineering students to navigate the complexities of international collaboration and contribute meaningfully to the global engineering community. The emphasis on discussions, role plays, and real-world problem-solving scenarios in both Technical English I and II not only enhances language skills but also builds the confidence of students to communicate effectively in engineering-related contexts. The mixture of the class with students from different language background like Arabic, Chinese, Vietnamese, Indian languages, and German prepares them for real life working situations where they are more likely to work with other non-native speakers using English as a lingua franca than actually speaking to English native speakers. The additional possibility of the tandem to practice in a one-on-one situation with a native speaker of English further contributes to their confidence in speaking, but also allows them to gain intercultural competences.

In conclusion, it can be said that in contrast to the more conventional classroom-based learning, these specialized programs offer a dynamic and hands-on approach that aligns more closely with the language needs and interests of STEM students, ultimately better preparing them for success in their future careers.

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