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VYSOKÉ UČENÍ TECHNICKÉ V BRNĚ

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ÚSTAV JAZYKŮ

Content and Language Integrated Learning (CLIL) in Engineering Courses at Brno University of Technology
Integrovaná výuka předmětu a cizího jazyka (CLIL) v odborných předmětech na Vysokém učení technickém v Brně

BACHELOR'S THESIS
BAKALÁŘSKÁ PRÁCE

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Bakalářská práce

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POKYNY PRO VYPRACOVÁNÍ:

Vymezte koncepci integrované výuky předmětu a cizího jazyka (CLIL), diskutujte o jeho významu pro vysokoškolské studenty, roli učitelů CLIL a analyzujte možné faktory bránící úspěšné implementaci CLIL v odborných předmětech na univerzitách.

DOPORUČENÁ LITERATURA:

1) Coyle, D., Hood, P., & Marsh, D. (2010). CLIL. Content and language integrated learning. Cambridge: Cambridge University Press.
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Abstract

The bachelor's thesis aims to frame the content and language integrated learning (CLIL) concept and analyse some factors influencing the successful implementation of CLIL in engineering courses at Brno University of Technology. The theoretical part of the thesis discusses the advantages of CLIL, explains Coyle, Hood and Marsh's CLIL framework, and describes different pedagogical models and strategies used to integrate CLIL into a curriculum. It also provides a survey of selected CLIL research studies which has shown that the use of CLIL at universities has a significant influence on learning a content-based subject through the medium of a foreign language. The practical part of the thesis deals with research focusing on the current situation of CLIL in engineering courses in the study programme English in Electrical Engineering and Informatics at Brno University of Technology. The results of the questionnaire survey among teachers and students are discussed, and possible improvements in CLIL lessons are considered.

Key Words

CLIL, foreign language, 4C framework, language triptych, CLIL methods, educational materials, interaction, scaffolding, zone of proximal development, questionnaire survey

Abstrakt

Cílem této bakalářské práce je vymezit koncepci integrované výuky předmětu a cizího jazyka (CLIL) a analyzovat některé faktory, které ovlivňují úspěšnou implementaci CLIL v odborných předmětech na Vysokém učení technickém v Brně. Teoretická část práce diskutuje výhody CLILu, vysvětluje model Coyleové, Hooda a Marshe a popisuje využití různých pedagogických modelů a strategií při integraci této metody do kurikula. Zároveň také předkládá přehled vybraných výzkumných studií zaměřených na využití CLILu, který ukazuje, že CLIL má na univerzitách významný vliv na výuku odborných předmětů prostřednictvím cizího jazyka. Praktická část práce se zabývá výzkumem zaměřeným na aktuální situaci CLILu v odborných předmětech studijního programu Angličtina v elektrotechnice a informatice na Vysokém učení technickém v Brně. Závěrem práce diskutuje výzkumná zjištění vyplývající z dotazníkového šetření mezi učiteli a studenty a navrhuje, jakým způsobem výuku prostřednictvím CLILu zdokonalit.

Klíčová slova

CLIL, cizí jazyk, rámec 4C, jazykový triptych, metody CLILu, výukové materiály, interakce, scaffolding, zóna nejbližšího vývoje, dotazníkové šetření

Rozšířený abstrakt

Tato bakalářská práce se zabývá integrovanou výukou předmětu a cizího jazyka (CLIL), tzn. přístupem používaným k výuce jakéhokoli předmětu, například fyziky, matematiky, chemie či biologie v cizím jazyce. Koncepce CLILu je využívána na Vysokém učení technickém v Brně (VUT) zejména ve studijním programu Angličtina v elektrotechnice a informatice (H-AEI). Přestože většina studentů program úspěšně dokončí, existuje několik problémů, se kterými se při studiu musí vyrovnat.

Cílem bakalářské práce je seznámit čtenáře s metodikou CLILu a zaměřit se na problémy, které se v souvislosti s touto metodikou každodenně vyskytují, a to prostřednictvím vysvětlení metod a strategií, které mohou usnadnit začleňování CLILu do učebních osnov. K tomu byla využita především kniha Coyleové, Hooda a Marshe (2010), která koncepci CLILu velmi důkladně vymezuje. V současnosti je CLIL na vzestupu a získává značnou popularitu, takže nebylo obtížné hledat k této problematice relevantní informace.

Poslední kapitola teoretické části předkládá přehled vybraných teoretických a empirických studií, které popisují implementaci CLILu v pěti předmětech, a to v chemii, přírodní vědách „science", biologii, matematice a sociologickém vzdělávání. Hlavním cílem přehledové studie bylo ukázat vliv CLILu na různé oblasti výuky. Nejdůležitějším závěrem této přehledové studie je skutečnost, že používání metody CLIL ve výuce umožní studentům rozvíjet řečové dovednosti a odbornou slovní zásobu v cizím jazyce a postupně dosáhnout většího sebevědomí v oblasti učení se konkrétnímu předmětu. Navíc vzdělávání na univerzitní úrovni vyžaduje strukturální změny ve vyučovacích postupech včetně začlenění hledisek, obsahů a pojmů souvisejících s CLILem do učebních osnov.

Druhou částí bakalářské práce je praktická část, jejímž cílem bylo diskutovat o roli CLILu na VUT a navrhnout, jak by se metodika CLILu mohla zdokonalit, aby se zvýšila kvalita vzdělávání. Pro lepší pochopení, co přesně je nutné změnit či zdokonalit, byly vytvořeny dva dotazníky s využitím doporučené literatury. Jeden dotazník byl určen pro učitele odborných předmětů a druhý pro studenty studijního programu H-AEI. Pro sběr dat a generování statistických údajů byl použit online dotazníkový systém Survio. Po vyplnění dotazníků učiteli a studenty proběhla analýza a interpretace získaných dat.

Praktická část se skládá z kvantifikace výsledků výzkumu, analýzy odpovědí na otevřené otázky, pedagogických implikací a doporučení týkající se výuky CLILu v odborných

předmětech. Kvantitativní výsledky výzkumu jsou prezentovány v tabulkách, které porovnávají odpovědi studentů a učitelů pro získání lepšího přehledu o jejich názorech. Z kvantitativního výzkumu je důležité zmínit, že 88 % studentů mělo certifikát z anglického jazyka, zatímco většina učitelů (75 %) naopak certifikát z angličtiny neměla. Dalším důležitým faktorem je, že 38 % studentů si přálo, aby se výuka zaměřovala především na odbornou terminologii. Z výzkumu také vyplývá, že 40 % učitelů odborných předmětů si uvědomují skutečnost, že potřebují zkvalitnit své znalosti anglického jazyka a téměř 45 % studentů si myslí, že je třeba věnovat více času mluvení v angličtině.

Cílem analýzy odpovědí na otevřené otázky bylo analyzovat výpovědi respondentů a následně diskutovat o přínosech a možných omezeních implementace CLILu v odborných předmětech studijního programu H-AEI. V textu jsou uvedeny komentované odpovědi, a to jak ze strany studentů, tak ze strany učitelů, které byly doslovně přepsány, včetně gramatických a pravopisných chyb, kterých se respondenti dopustili. Z odpovědí na otevřené otázky jsem především zjistila, co studenti při studiu odborného předmětu v angličtině považují za nejpřínosnější, proč při výuce odborného předmětu v cizím jazyce zvládli podstatně méně učiva, zda jim vyhovuje písemná nebo ústní zkouška a jaké změny by měly být ve výuce odborných předmětů prostřednictvím CLILu realizovány. Učitelé byli dotazováni na to, zda se studenti mohou dozvědět více informací, když se odborný předmět vyučuje v angličtině, proč se studenti naučí méně než při výuce v českém jazyce a zda učitelé používají pro výuku odborného předmětu v angličtině pouze anglické odborné knihy, či nikoliv.

Po okomentování všech otevřených otázek a jejich analýze jsem si udělala lepší představu o nedostatcích ve výuce odborných předmětu v anglickém jazyce. Kapitola „Pedagogické implikace a doporučení pro CLIL v odborných předmětech" uvádí, že primárním cílem je řešit problémy, které studenti a učitelé zmínili, a ukázat, jak lze výzkumná zjištění společně s modely CLILu uvedenými v teoretické části práce snadno implementovat.

Ukázalo se, že mnoho studentů má jazykovou bariéru a má problém porozumět nejen obecné angličtině, ale i odbornému jazyku. Navrženým řešením tohoto problému je podpůrná strategie ze strany učitelů, tzv. scaffolding. Podstatné je také integrovat několik metod, které byly popsány v teoretické části této práce. Vhodná kombinace různých výukových postupů a metod může výrazně přispět ke zdokonalení CLIL v odborných předmětech studijního programu H-AEI.

Dalším popsaným problémem, je absence učebnice v angličtině a českém jazyce. Četba odborných informací v mateřském jazyce by byla pro studenty mnohem snazší pro porozumění než četba v cizím jazyce. Za tímto účelem byla doporučena koncepce jazykového triptychu z teoretické části práce.

Studenti uváděli, že mají někdy problém porozumět angličtině učitele, protože nepoužívá správnou odbornou terminologii. Řešením tohoto problému by mohlo být, aby učitelé absolvovali oficiální zkoušku z anglického jazyka, která by zhodnotila jejich schopnost se studenty efektivně komunikovat. Kromě toho by stálo za zvážení uskutečnit vzdělávací workshopy na VUT, kde by se učitelé, kteří vyučují prostřednictvím CLIL, mohli podělit o osobní zkušenosti.

Tato bakalářská práce ukazuje, že CLIL je důležitý a užitečný koncept, který má při správném použití mnoho výhod. Praktická část práce spolu s dalšími empirickými studiemi uvedenými v teoretické části poskytují cenné poznatky, které lze využít ke zkvalitnění a usnadnění vzdělávání. Na každé univerzitě se objevují problémy, které lze prostřednictvím některých z uvedených doporučení vyřešit, a tak usnadnit studium prostřednictvím metody CLILu jak studentům, tak učitelům.

Denysenko, V. (2023). *Integrovaná výuka předmětu a cizího jazyka (CLIL) v odborných předmětech na Vysokém učení technickém v Brně*. Brno: Vysoké učení technické v Brně, Fakulta elektrotechniky a komunikačních technologií. 80 s.
Vedoucí bakalářské práce: Mgr. Ing. Eva Ellederová, Ph.D.

Prohlášení

Prohlašuji, že bakalářskou práci na téma *Content and Language Integrated Learning (CLIL) in Engineering Courses at Brno University of Technology* jsem vypracovala samostatně pod vedením vedoucí bakalářské práce a s použitím odborné literatury a dalších informačních zdrojů, které jsou všechny citovány v práci a uvedeny v seznamu literatury na konci práce.

Jako autorka uvedené bakalářské práce dále prohlašuji, že v souvislosti s vytvořením této práce jsem neporušila autorská práva třetích osob, zejména jsem nezasáhla nedovoleným způsobem do cizích autorských práv osobnostních a/nebo majetkových a jsem si plně vědoma následků porušení ustanovení § 11 a následujících zákona č. 121/2000 Sb., o právu autorském, o právech souvisejících s právem autorským a o změně některých zákonů (autorský zákon), ve znění pozdějších předpisů, včetně možných trestněprávních důsledků vyplývajících z ustanovení části druhé, hlavy VI. díl 4 Trestního zákoníku č. 40/2009 Sb.

V Brně dne 27.5. 2023   ....

                                                                        Valeriia Denysenko

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Table of Contents

1 Introduction

The content and language integrated learning (CLIL) method is a type of bilingual education that allows students to expand their cultural horizons and improve the quality of their education beyond the traditional curriculum. Mastering the subject content and a foreign language accelerates the development of students' professional skills and opens up new opportunities for further education and work. Specific organizational and pedagogical conditions which manage high-quality subject content are necessary for the effective implementation of CLIL, realizing its full potential for learning a foreign language.

My motivation for choosing the topic of CLIL was straightforward. Most students and teachers use CLIL in everyday life without realizing it, so this thesis should aim to provide the reader with valuable yet comprehensible information. The Internet is full of different sources, and one can get lost while searching for relevant and accurate information. This thesis, however, frames the fundamental concept of CLIL and can be used as a guide for implementing CLIL at universities or schools. Hence, as a student who learns technical subjects through the CLIL methodology at Brno University of Technology, I believe that even though the quality of education is already very high, there is still something to be improved. For this reason, I decided to conduct a questionnaire survey to learn about the current state of CLIL in engineering courses, with anticipation that the analysis of the survey results will help improve the educational quality.

The bachelor's thesis is divided into a theoretical part and a practical part. The theoretical part of the thesis outlines the historical development of CLIL, describes how CLIL is used these days, explains the methodological principles of CLIL application, and defines various models of practical implementation. The second chapter of the theoretical part will help the reader become familiar with different teaching models, such as interdisciplinary connections and the content-thematic approach. The former model implies that teachers will cooperate with each other and discuss lesson plans, while the latter analyses the same concepts in different cultures.

The purpose of the following third chapter is to describe strategies that CLIL involves. Knowing different strategies is very beneficial for understanding how to implement CLIL in universities. Each teacher might have their own teaching method. However, since CLIL is not typical and has been only recently developed, it is important to know about the variety of CLIL strategies and the role of a teacher in it. These strategies do not have to be

complicated. For instance, one of the strategies describes the benefit of listening to podcasts in a foreign language. It allows students to listen to the topic they are interested in, as well as listen to everyday language used by native speakers. There are several other strategies, e.g., active interaction. It has been shown that the learning process is faster when students actively use the material during communication.

The next chapter provides a survey on CLIL studies. The survey focuses on five subjects – chemistry, science education, biology, mathematics, and sociology. The analysis of each survey is presented and shows how this concept works in different fields, and the impact CLIL has. It has also shown how CLIL indeed helps to learn both the language and the subject, prepares students for future studies and incorporates a wide range of cultural contexts into lessons.

The practical part consists of four main chapters. First, the research objective is formulated, and the research context is considered. The research methodology describes the design of the questionnaires, how the questionnaire survey was conducted and how many people participated in the survey. The practical part then presents quantitative research results in tables with relative and absolute frequencies and analyses the results. Besides, it provides a qualitative analysis of students' and teachers' answers to open questions and evaluates their statements to get a clear understanding of the benefits and limitations of CLIL in engineering courses. Finally, pedagogical implications and recommendations for CLIL in engineering courses are discussed.

2 A theoretical concept of CLIL

Nowadays, the CLIL method is widely used in educational institutions. Its occurrence is dictated by the processes of globalization and objective conditions for the development of foreign language education in the world. CLIL[1] is an approach for learning a subject through a foreign language, and a foreign language through a taught subject. The term was coined by David Marsh[2] at the University of Jyväskylä in Finland in 1994. According to Marsh (2012), CLIL refers to situations in which academic subjects are studied in a foreign language and has the dual purpose of studying the subject while learning a foreign language.

2.1 Use of CLIL

The purpose of the methodology used in all CLIL classes is to expand knowledge in a certain area and improve knowledge and skills in language learning. This also leads to the development and disclosure of self-learning skills. Finally, it is very important to understand that they complement knowledge in the students' native language instead of replacing it.

Papaja (2013) claims that the role of a teacher in CLIL is crucial. A teacher helps and cooperates with students to explain and teach the context of the subject in the particular language. This allows students to understand the concept of the content while simultaneously learning a new foreign language. Therefore, the CLIL approach aims both at the acquisition of the foreign language and the subject content.

In traditional language teaching, the form and the structure of the target language are the main object of the subject, but CLIL is different. It promotes learning the foreign language with the subject content, which serves as a dual focus of teaching and learning (Moore, Evnitskaya & Ramos-de Robles, 2018). The point of cooperation between content and language teachers is somewhat implied in CLIL, where they both learn from each other and enhance learning of the new language. The dual focus involves hard work for both the teacher and the students, which directly links with a cognitive process where they both think

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[1] What differentiates CLIL from English for specific purposes (ESP) is that the former places emphasis on providing learners with sufficient language skills to master content knowledge, while the latter has dual focuses, i.e. both language and content. Thus, ESP is one category of English Language Teaching (ELT), while CLIL is not. (Yang, 2016, p. 45)

[2] David Marsh is a Doctor of Philosophy who has developed strategies and implemented innovations in education. He was part of the team which conducted groundwork leading to the launch of the term Content and Language Integrated Learning (CLIL) in 1994.

in their own language and express their ideas in the new language.

2.2 Advantages of CLIL

The CLIL method can significantly increase the motivation of children and adolescents to learn a language in schools and universities since language is not a goal but a means to study other subjects. This approach has many important features that allow CLIL to achieve significant results. Despite the complexity of its implementation, many educational institutions consider using this approach. Zemach (2021, August 11) comments that the CLIL method has many advantages thanks to which this system works since it:

- allows students to communicate effectively in a foreign language and speak naturally in everyday life,
- improves the intercultural knowledge of students,
- improves students' ability to think in a foreign language,
- develops all language skills (speaking, writing, reading and listening),
- develops an interest in different languages and how they are used in various spheres of life,
- does not require additional study time,
- develops the ability of students to communicate in a foreign language in natural situations, as also noted by Aguilera et al. (2019).

2.3 The 4Cs framework of CLIL

According to Coyle, Hood and Marsh (2010), within the framework of the CLIL technology, the lesson is based on the "4Cs". The "4Cs" implies combining learning subject content and language within a particular context or situation, which determines the interaction of the following components in a lesson: content, communication, cognition and culture, as illustrated in Figure 1.
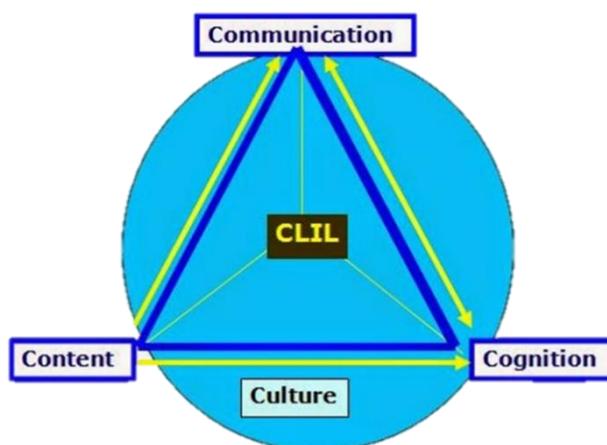
Figure 1. The 4Cs framework. Adapted from Coyle et al. (2010, p. 76).

Evans (2019, August 27) describes all the components as follows.

Content is related to the development of interdisciplinary connections for the acquisition of knowledge, skills and competencies on specific topics. Content is the subject or the CLIL topic. For instance, using the CLIL methodology during a biology lecture, biology terms will be learnt in a foreign language.

Language (communication) is used as a medium to perform tasks and develop projects. It involves the use of a foreign language for teaching in order to gain knowledge on any subject. In this case, language is not an object of study but a means of communication. Students apply the knowledge in practice and immerse themselves in the language environment.

Learning cognition concerns the development of a cognitive activity because thinking is the main component for mastering a foreign language. Cognition is a thinking skill that students use to engage with and understand the content. A foreign language is always used parallel to a mother language to acquire new knowledge and skills. Using English for thinking enriches understanding of complex concepts.

Culture is an integral part of learning a foreign language. Mastering a language does not only involve acquiring a rich vocabulary and knowing the grammatical structure of the language but also learning its cultural subtleties and broadening horizons. The ability to communicate and think in English is essential for living and working in a multilingual, globalized environment.

Цуканова (2019) points out that the CLIL technology is implemented through:
- consistent acquisition of knowledge and skills of specific content, and its

understanding,

- cognitive process,

- communicative interaction in a given context,

- development of language knowledge, skills and competencies,

- cultural self-awareness.

2.3.1 Language triptych

According to Pozo (2016), the language triptych (Figure 2) is a key concept of the CLIL approach, and its use is necessary for communication, which is one of the 4Cs. The language required in CLIL does not necessarily correspond to the grammatical progress that is usually observed in the context of language learning. The fact that a language can be learned as naturally as a native one is a great advantage. The language triptych allows linking content and language objectives. In this way, it is possible to integrate cognitively complex content with language learning and using, as well as give meaning to the relationship between the use of language and the construction of knowledge.
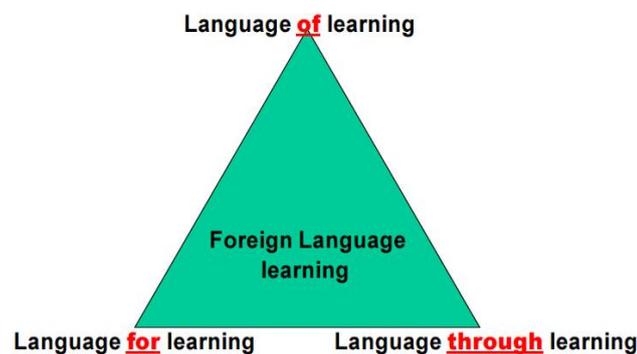
Figure 2. The language triptych. Adapted from Coyle et al. (2010, p. 69).

Kraucher (2021, August 4) explains that the language triptych represents a triangle that has three concepts, the language of learning, the language for learning and the language through learning.

The language of learning is the language that students need to understand the basic concepts and skills on a certain topic. It allows the student to use the appropriate language in a meaningful context.

The language for learning is a language that is used in the context of a foreign language.

Knowing different strategies, students will be able to effectively use a foreign language. That is where *scaffolding*[3] is used (more will be discussed in Chapter 3). A teacher needs to help students to develop the skills necessary to work in pairs, collaborate in groups, ask questions, discuss, make discoveries and think. The language they learn is adapted to the subject.

The language through learning is used for students who actively use the language and think in it. Effective learning cannot occur without the active use of language and thinking.

2.4 Types and models of the use of teaching methods in CLIL

Coyle et al. (2010) consider various options for implementing CLIL methods as separate models and interpret this process as "CLIL mobility". They believe that CLIL uses a flexible, contextual approach and that contextual factors influence the development of various CLIL models.

The subject or topic of the curriculum is an approach to studying a subject in a foreign language and studying the discipline from a different point of view (studying electrical engineering in a foreign language). *Interdisciplinary connections* is the approach that requires that a foreign language teacher and another one who is teaching a different subject have to plan together the teaching of various aspects of the same topic. *The content-thematic approach* involves a comparative analysis of topics in order to see differences in the understanding of the same concept in different countries and cultures. *Integrated curriculum* redefines educational concepts. In the CLIL class, the concepts of a foreign language can be viewed from different points of view (for example, the concept of "water" can be studied from a scientific, geographical or historical point of view).

As it was mentioned, CLIL is a generalizing term that includes numerous teaching methods and approaches. Therefore, when drawing up a CLIL programme, each teacher selects his own organization of the process, chooses a suitable CLIL learning model.

According to Coyle et al. (2010), there are distinct factors influencing the choice of the CLIL model:

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[3] Scaffolding refers to a variety of instructional techniques used to move students progressively toward stronger understanding and, ultimately, greater independence in the learning process. The term itself offers the relevant descriptive metaphor: teachers provide successive levels of temporary support that help students reach higher levels of comprehension and skill acquisition that they would not be able to achieve without assistance (The Glossary of Education Reform, n.d.).

- teacher's capabilities,
- language proficiency,
- the time allotted for CLIL training,
- evaluation system.

Soft and hard CLIL

As Stannard notes (2017, December 12), CLIL can be divided into "hard" and "soft" methods. In the soft method, the main attention is paid to a foreign language, and its learning is the main goal. The hard method has the opposite goal: the subject content itself is considered more important, while language acquisition is a secondary goal. These two concepts are applied in schools and universities. In order to meet the requirements of an integrated subject-language approach, foreign language teachers, or subject teachers, need to make changes to the methodological principles of their work; these transformations are the basis of CLIL.

Teaching entirely or partially in the foreign language

In accordance with Coyle et al. (2010), there are two levels of learning models based on CLIL technology:

1) Teaching entirely in a foreign language

In this model, the language is used to summarize and repeat topics and material, practically without using the native language. There is a clear concentration on the content, language and cognitive activity. The subject content is studied in a foreign language, in the form of learning new words, phrases, grammatical functions and structures related to the topic being studied. The described model assumes setting and achieving goals in improving both subject and linguistic knowledge.

2) Teaching partially in the foreign language

In this model, the subject content taught in the studied language makes up less than 5% of the entire CLIL programme. The use of the studied and native language alternates. One language can be used for summarizing information and the other for conducting a lesson. Students switch from one language to another. It depends on how everything is planned during the lesson and the programme as a whole. For instance, students can do homework in their native language to absorb new information. To answer a question during a lesson, a student can use the language that one considers most acceptable. Thus, either the teachers or

universities can vary the programmes and independently develop CLIL learning models.

There is another bilingual teaching method, which is often confused with CLIL. *English as a medium of instruction (EMI)* uses English to teach general and special subjects in countries where English is not the native language for the majority of the population (Blue, 2018, May 4). The main goal of EMI is not to master English.

Dearden (2017, February 2) states that the difference between the EMI and CLIL concepts is as follows:

- in CLIL, the language of instruction can be any language. EMI assumes that the language of instruction is English.
- CLIL directly involves learning both content and language, while for EMI the results of language proficiency are secondary.

2.5 Integrating and adapting CLIL to a curriculum

As claimed by Зарипова, Салехова and Тюкарева (2015), CLIL based on full immersion in a foreign language is quite difficult to implement at the initial stages. Therefore, it is possible to start by including CLIL elements in the learning process. Such elements may include the following activities and exercises:

- analysing equivalents of terms in the proposed text or task in the native language,
- highlighting keywords,
- creating a mind-map for much faster and easier remembering.

Therefore, when planning and conducting a CLIL class, the first steps follow an invented plan: educational materials are selected and means of pedagogical communication are planned for further practice.

Summary of Chapter 2

In this chapter, the concept of CLIL, its advantages, types and models were introduced. The 4Cs framework, established by Coyle et al. (2010), was presented with an illustration to make it easier for a reader to apprehend. The language triptych was described using a triangle illustration. Examples with detailed explanations were provided to elucidate the advantages of implementing CLIL. Both methods of soft and hard CLIL were briefly discussed. Since CLIL is often mistaken for EMI, it was important to define EMI and its use zone. Finally, integrating CLIL into a curriculum was introduced.

3 CLIL strategies

When organizing a programme using CLIL technology, teachers face the problem of the lack of a wide selection of educational materials. This is due to the fact that each teacher decides for himself what to focus on when teaching – on the subject or on the language. This forces teachers to develop their own teaching materials. However, there are cases when the CLIL curriculum does not bring the expected results. For the successful implementation of CLIL training, it is essential to consider a number of principles and techniques when developing tasks. Meyer (2010) formulates the main strategies for the successful use of CLIL techniques: a variety of educational materials and resources in education and scaffolding.

Variety of educational materials and resources in education
Mehta (n.d.) points out that materials for students should be stimulating and correspond to the level of their development. The selected information should relate to the student's topic of interest. Meaningful foreign language teaching is most effective when new topics encourage students to learn and apply their experience to acquire new knowledge.

Kennedy (2020, August 17) mentions that one of the key concepts in the selection of material is *multimodal input*.[4] It implies the presentation of materials in various visual ways (for example, diagrams, tables, maps, etc.) to better understand the particular subject content in a foreign language. Translating information from the text to diagrams or from the native language to the target language stimulates learning the language and subject in various ways, taking into account the student's individual needs.

Ramsay (2020) writes that YouTube videos, podcasts or Netflix are interesting resources that not only motivate students to learn, but also help students master the language used in everyday life in agreement with cognitive academic language proficiency (CALP)[5]. They can be used to create tasks that contribute to the activation of higher-order mental operations.

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[4] Multimodal learning suggests that students understand and remember more when learning involves multiple senses – visual, auditory, and kinaesthetic (Lawless, n.d.).
[5] CALP is the language ability required for academic achievement in a context-reduced environment. Examples of context-reduced environments include classroom lectures and textbook reading assignments, where there are few environmental cues (facial expressions, gestures) that help students understand the content (Sanako, n.d.).

Intensive interaction of the teacher with students

Long's interaction hypothesis[6] (1996) suggests that students quickly learn the language and use it to communicate. Feedback received during communication contributes to the development of language skills and abilities of students, as the communication process is coherent and promotes the productive use of the material. Swain and Johnson (1997) argue that using what has been really learned will improve the proficiency of the language the student is learning. The learning process should be structured in such a way that students can make the most of what they have learned in the classroom.

Meyer (2010) notes that task-based language teaching (TBLT)[7] contains many methodological findings for teaching a foreign language and thereby confirms that TBLT should be an integral part of CLIL. TBLT contributes to the formation of a language environment in the classroom. According to this approach, mastering a non-native language is most successful in situations of real communication in a meaningful social context.

Scaffolding

Scaffolding is support that a teacher temporarily provides in various ways. The main role of the teacher is to support the language needs of the student. This means understanding what knowledge already exists, leading a student to the right conclusion and being able to teach information so that it suits the student using different learning styles[8].

Scaffolding is based on Vygotsky's method. According to Vygotsky (1987), this is a teaching approach that allows students to get much more information that students will be able to memorize much faster since they do not rely only on traditional teaching methods. Scaffolding has several features (Прудникова, 2019):

- facilitates learning of large volumes of subject and language information (i.e., input scaffolding),
- encourages the use of foreign languages through the use of theme-based glossaries and the use of standardized expressions necessary to complete the task,

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[6] The interaction hypothesis is a theory of second-language acquisition which states that the development of language proficiency is promoted by face-to-face interaction and communication (Johnson & Johnson, 1999).

[7] Task-Based Language Teaching (TBLT) is an educational framework for the theory and practice of teaching second or foreign languages (Van den Branden, 2022). TBLT adopts meaning-based, communicative tasks as the central unit for defining language learning needs.

[8] Learning styles are different ways students process information and thereby learn optimally; they include concrete experience, reflective observation, abstract conceptualization and active experimentation (Coffield et al., 2004).

- promotes the development of CALP.

Teacher support is necessary because it might be difficult for students to understand material that includes unfamiliar vocabulary and grammatical structures. Therefore, questions and tasks should be specially organized in such a way as to facilitate the understanding of the lesson content. In addition, scaffolding strategies help students progress toward stronger understanding in a foreign language and they increase their self-confidence.

3.1 Zone of proximal development

Vygotsky (1987) describes the zone of proximal development (ZPD) as the range of abilities a person can perform with help but cannot yet perform independently. Figure 3 demonstrates the tasks that the learner can and cannot do in greater detail. These skills are called "proximal" because a person is close to mastering them but needs practical guidance to be able to perform these actions without counselling.
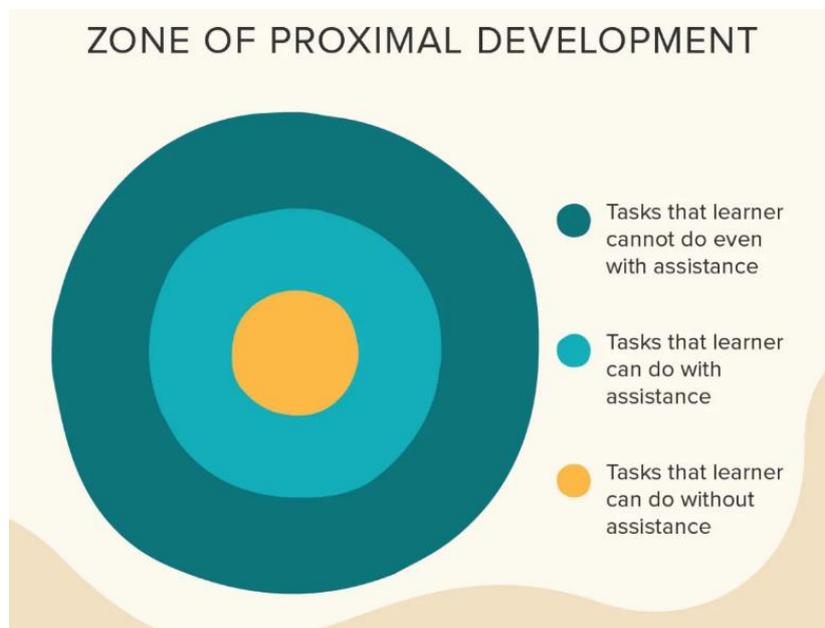
Figure 3. Zone of proximal development. Reprinted from https://www.healthline.com/health/zone-of-proximal-development :

Not using scaffolding in the ZPD: "Read the text and do the tasks after it."

Scaffolding in the ZPD: "Before doing the tasks, read the text and highlight words you are not familiar with. We will go through them together."

The very first example does not cover scaffolding. A teacher expects students to perform the tasks on their own. There is neither guidance nor support. However, with scaffolding, a teacher provides some extra support before students start performing any task. This way, if they do not understand an assignment, scaffolding prevents their demotivation due to a lack of understanding. Scaffolding also helps increase students' confidence and capability and enables them to perform more advanced tasks once the scaffolding is removed.

Summary of Chapter 3

This chapter focused on CLIL strategies. Teachers should have a well-thought strategy in CLIL so that students can form links in their minds between their first language, the target language and the subject content. One of the important strategies is scaffolding. Scaffolding helps the student with tasks that cannot yet be done without the help and also allows them to complete tasks that can already be done individually. Vygotsky's ZPD was introduced and instances of how to use it properly were given. The ZPD is similar to scaffolding because its main objective is to provide a student with enough guidance so that one can do the tasks unassisted.

4 A survey of selected CLIL studies

This chapter will analyse current theoretical and empirical studies focusing on CLIL methodology at universities. The research describes mainly five areas where CLIL was applied: chemistry, science, biology, mathematics and sociology education at the university level. The chapter aims to:

1) describe the objective of the study,

2) describe the subject that was studied using CLIL,

3) inform who participated in the research,

4) methods and research tools that were used, and

5) summarize the research results.

The first empirical study by Clotilde and Checchetti (2016) deals with the implementation of CLIL into chemistry lessons with IBSE[9] (Inquiry Based Science Education) methodology. This study describes how to incorporate CLIL into a third-year university education analytical chemistry subject and focuses on a particular part of chemistry called spectroscopy, which is a study of the absorption and emission of light.

A group of 19-year-old students who lacked the motivation to learn a foreign language and, as a result, had Lower-B1 linguistic abilities were given this course to complete. The focus of a CLIL session gradually shifted to another content, which then served as the foundation for learning the language. Students simultaneously acquired the language for their studies.

It is important to provide students with a suitable scaffold for language use, which could be verbal (such as writing prompts or definitions, meta-linguistic clues, etc.), procedural (for instance, an instructional framework, mutual dictation, or dictogloss[10]), or educational tools (including graphic organizers, visuals, or multimedia). As a result, by using the IBSE methodology, the authors were able to engage students in various activities such as observation, exploration, computer use, data processing, and reflections that enabled to learn the material through communication in a foreign language.

The second study by Piacentini (2021) has a theoretical character and explicates the relations

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[9] IBSE encourages students to ask questions and emphasizes students' ideas. The five stages of the IBSE methodology are orientation, conceptualization, investigation, conclusion, discussion, and evaluation (Drew, 2022, November 10).

[10] Dictogloss is classroom dictation that requires students to reconstruct short texts by listening and writing down key words (British Council, n.d.).

of CLIL with science education and aims to review English as a foreign language used during science classes. Science education is important for both lifelong learning and the dissemination of knowledge. According to Martins (2014) and Salehjee and Watts (2020), science is a reflection of modern culture, and the way people think and understand the world.

This study confirms the position taken by the Language Across the Curriculum[11] policy. The research by Piacentini (2021) also presented an existing positive effect on teaching/learning science in CLIL. Language indeed plays a function in building knowledge in science classrooms, and its role has evolved from information transmission to the interpretation of personal experience to engage in professional organizations. According to the Vygotskian theory of social learning, communication through language with others is the primary factor in brain development (Vygotsky, 1990, as cited in Cherry, 2022).

The third empirical study by Satayev et al. (2022) describes an application of CLIL in biology lessons. The aim of the research was to explore the effectiveness of team teaching enhanced CLIL on student achievement. This study focuses on the examination of the impact of team teaching increased CLIL on students' academic performance in biology. Writers conducted quasi-experimental research[12] with a sample of biology education students divided into control and experimental groups to assess the impact of the CLIL technique on student achievement within the context of interdisciplinary/cross-curricular teaching.

Satayev et al. (2022) conducted research where biology students enrolled in an introductory biology class at the University of Kazakhstan. There were 12 students in the control group, while 13 students were in the elementary group. The biology instrument test consisted of 25 multiple questions, with access to four different areas for the students. These areas were an introduction to digestion, steps in digestion, organ of the digestive system, digestive secretion, and diseases of the digestive system. Satayev et al. (2022) found that CLIL significantly improved student achievement both in Biology subject knowledge and the English language and highlighted the critical value of CLIL.

The fourth empirical study by Surmont et al. (2016) highlights the influence of CLIL on mathematics. The study aimed to find out whether secondary school pupils who learn in a CLIL environment outperform their traditionally schooled peers in mathematics.

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[11] (LPAC) brings together different forms of language education within the school in order to emphasize the role of language in all subject learning (Singh, 2021).

[12] Quasi-experiments are studies that aim to evaluate interventions but that do not use randomization (Harris et al. 2006).

Mathematics is a unique subject with a respective mathematical register that distinguishes it from one's everyday use of grammar, structure, and lexis in an everyday classroom. Moreover, it is difficult for teachers and students to talk in the technical language of mathematics for learning purposes. For this purpose, English is most commonly used to conduct mathematics studies for learning.

Secondary school pupils in their first year participated in the study. There were two groups – the first group consisted of 35 pupils who were taught CLIL methodology, and another group included 72 pupils who followed traditional education. All of them were tested using a mathematical test at the beginning of the year, after three months, and after ten months. After testing students for the first time, scores were the same. However, several months later, the CLIL group scored higher than the non-CLIL group. To summarize, this study showed that CLIL has a positive impact on the mathematical performance of pupils even after a short period of time. According to Surmonts and Struys (2016), CLIL learners increased the learning process from traditional students after a very short time because the CLIL environment of study is vast and has dual benefits for students and teachers.

The fifth empirical study by Alimi (2013) discusses how CLIL influences sociology. The study aimed to describe a methodological model used in an experimental study on how to integrate character within the practice of CLIL in Indonesia. During this research, Karl Marx's[13] idea of religion was discussed in order to integrate English to deliver the content and the perspective of the curriculum.

For several weeks, the methodologies in the sociology of religion class were tested. Karl Marx's lessons were about learning English proficiency and skills. The idea of alienation and ideologies in the study of religion were sociological concepts. Besides, a discussion was conducted in the class where the students choose a paragraph from the Karl Marx chapter study on religion or the theory of religion. All students initially experienced difficulties gaining any content, but gradually, it became easy for them once they started. Furthermore, students also experienced other areas where they tried to learn a particular sociology content through English. The research showed that the integration of character within CLIL enriched the perspective of CLIL by strengthening the use of CLIL for intellectual growth and moral development.

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[13] Karl Marx was the ideologist of socialism, the author of the large-scale work "Capital" and the founder of Marxism. Marx's political and philosophical thought had a huge impact on subsequent intellectual, economic and political history (Kenton, 2022, August 31).

Summary of Chapter 4

Firstly, the methodological models presented in the selected studies aid in providing the students with a framework and useful techniques that might be employed at every stage and level of CLIL practice. Secondly, by implementing clearer and more concise reading procedures, CLIL can overcome its shortcoming in incorporating texts into its learning process. When texts are considered selectable, controllable sources of information, using texts in the context of CLIL can be enjoyable. Thirdly, text orientation and choice can give teachers and students a feeling of control over a chapter with a lot of text. The text selection is followed by text orientation to emphasize what has been learned. Structural changes to the teaching methods are necessary to implement character education at the university level and integrate character viewpoints and materials into the curriculum.

Most importantly, as Alimi (2013) notes, university-level character education calls for structural changes to teaching practices as well as the inclusion of character-related perspectives and contents in the curriculum. The use of CLIL in the classroom helps students develop their foreign language skills and specialized vocabulary in the same ways as the approach helps them develop their subject-matter confidence. There are also more plays and games that help students develop their character. This is comparable to teaching morals without outlining the elements of those morals.

The theoretical part of this bachelor's thesis introduced the CLIL concept, its use and advantages. CLIL is a new yet versatile approach. Therefore, the theoretical part dealt not only with the types and models of CLIL but also with teaching models and CLIL integration into a curriculum using the described strategies.

The following practical part of the thesis will examine the CLIL methodology at Brno University of Technology (BUT) and consequently recommend how to improve the implementation of the theoretical concepts of CLIL at universities.

5 Practical part

5.1 The research objectives and context

This research aims to examine the research findings that proceed from the questionnaire survey, discuss the role of CLIL at Brno University of Technology (BUT) and suggest how the CLIL methodology could be enhanced in order to improve the quality of education. The research tools were two questionnaires – one was for technical subjects' teachers and another for the students of the study programme English in Electrical Engineering and Informatics (H-AEI).

H-AEI is a programme that is mainly taught in English by Czech teachers and the programme focuses on studying electrical engineering subjects and in-depth knowledge of the English language. Students also learn linguistics, pragmatics, discourse analysis and have subjects such as a translation seminar. The translation seminar deals with frequent mistakes that are made when translating and the seminar as well focuses on showing different practical tools for the translation from English to Czech and vice versa. All this is taught and studied so that students can then do technical translation and be experts in both engineering and linguistics.

With that being said, the technical subjects in the H-AEI study programme use mainly the CLIL concept, even though some teachers are not even aware of its existence, as their answers in the questionnaire survey indicate. It is also important to know students' opinions in order to help teachers understand how lessons can be improved.

The research consisted of a preparation phase, a realization phase and an evaluation phase. During the preparation phase, I created two questionnaires (see Appendices 1 and 2) in cooperation with my supervisor, using the recommended literature. I then developed a plan for doing the research and how to use the questionaries. I chose to make an online questionnaire survey, as it is an accessible, time-saving and cost-effective method to gather all the responses in one place. I used Survio, an online survey system for the preparation of questionnaires, data collection and analysis that also automatically generated the responses and made the charts, so I could easily see the statistics.

I sent the questionnaire to teachers, described what my thesis is about, what CLIL is and why I need their help. As a second step, I sent the questionnaire to my fellow-students and former students who studied the same programme (H-AEI). The realization phase ended the day everyone submitted their answers. Overall, the goal was to get 40 respondents on the

student's side. After all, I managed achieve 39 respondents from the students who have already finished the study at BUT and those who currently study the H-AEI programme. Moreover, 15 teachers who teach the technical subjects through the CLIL methodology in the H-AEI study programme contributed to the survey.

In the evaluation phase, it was important to sort out the survey results, analyse and discuss them so that it can be understandable how the survey meets the research objectives. The tables with questions, as well as results with figures will be presented in the following chapter.

5.2 Quantitative research results

In this chapter, the collected data are presented, analysed, described and interpreted. The statistics that are shown in the tables were generated using the website Survio. The quantitative research results are divided into three parts focusing on 1) comparison of students' and teachers' answers to the same questions to obtain a better insight of their opinions, 2) students' responses and 3) teachers' responses.

As shown in Table 1, 88% of students had a certificate in the English language. It is surprising to see that the majority of teachers (75.00%), on the other hand, did not have a certificate in English, as Table 2 illustrates. Only one teacher had a doctoral degree (6.25%) and one had a state maturita exam in English (6.25%). Furthermore, 1 respondent (6.25%) had a Cambridge English certificate: Preliminary. Overall, it was not expected to see such a low percentage of teachers who did not have any certificate in the English language.

Table 1. *Students' certificates in the English language*

Answer	Absolute frequency	Relative frequency
State maturita in English	14	28.00%
Bachelor's degree in English	12	24.00%
Master's degree in English	1	2.00%
Doctoral degree in English	0	0.00%
Cambridge English: Preliminary	1	2.00%
Cambridge English: First	6	12.00%
Cambridge English: Advanced	4	8.00%
Cambridge English: Proficiency	2	4.00%
Other	4	8.00%
I do not have one	6	12.00%
Total	50	100.00%

Table 2. *Teachers' certificates in the English language*

Answer	Absolute frequency	Relative frequency
State Maturita in English	1	6.25%
Bachelor's degree in English	0	0.00%
Master's degree in English	0	0.00%
Doctoral degree in English	1	6.25%
Cambridge English: Preliminary	1	6.25%
Cambridge English: First	0	0.00%
Cambridge English: Advanced	0	0.00%
Cambridge English: Proficiency	0	0.00%
Other	1	6.25%
I do not have one	12	75.00%
Total	16	100.00%

As Tables 3 and 4 demonstrate, most students (almost 58%) and teachers (88.24%) believed that English helped to develop both language skills and subject knowledge when learning a technical subject. However, some respondents also thought that learning a technical subject in English helped with language skill and subject knowledge. Only 10.53% of students responded that learning a technical subject in English developed neither language skills nor subject knowledge.

Table 3. *Students' opinion of what English helps to develop when learning a technical subject (e.g. HDOM, HESO, HPOP, HARS, HVDE[14]).*

Answer	Absolute frequency	Relative frequency
Language skill	4	10.53%
Subject knowledge	7	18.42%
Both language skills and subject knowledge	22	57.89%
Neither language skills nor subject knowledge	4	10.53%
Other	1	2.63%
Total	38	100.00%

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14 HDOM – Digital Circuits and Microprocessors
    HESO – Electronic Devices
    HPOP – Computers and Programming
    HARS – Network Architecture
    HVDE – Electrical Power Production and Distribution

Table 4. *Skills and knowledge that teaching a technical subject in English helps students to develop*

Answer	Absolute frequency	Relative frequency
Language skills	1	5.88%
Subject knowledge	1	5.88%
Both language skills and subject knowledge	15	88.24%
Neither language skills nor subject knowledge	0	0.00%
Other	0	0.00%
Total	17	100.00%

Half of the teachers (50.00%) spoke only English during a class, while 22.73% of students chose to speak only English during the class (see Tables 5 and 6). Most students (56.82%) still used 30% of the Czech language in the technical subject classes. It is a positive sign that both students and teachers prefer speaking English, and the Czech language is used very rarely.

Table 5. *Language used during the class according to students*

Answer	Absolute frequency	Relative frequency
Speak only English	10	22.73%
Speak about 70% English, 30% Czech	25	56.82%
Speak about 50% English, 50% Czech	8	18.15%
Speak about 30% English, 70% Czech	1	2.30%
Total	44	100.00%

Table 6. *Teacher' use of English when teaching a technical subject*

Answer	Absolute frequency	Relative frequency
I speak only English in lessons	8	50.00%
I speak about 50% of the lesson time English and 50% Czech	3	18.75%
I speak about 70% of the lesson time English and 30% Czech	3	18.75%
I speak about 30% of the lesson time English and 70% Czech	2	12.50%
Total	16	100.00%

Table 7 illustrates that 44.83% of students thought more time had to be spent on speaking English, while only 24.14% believed they should focus on listening. A slightly surprising fact is that only 17.24% chose reading and 13.79% selected writing, even though writing skills are as crucial as speaking skills in the H-AEI study programme.

Table 7. *Time required to spend speaking English in technical subject lessons*

Answer	Absolute frequency	Relative frequency
Speaking in English	26	44.83%
Reading in English	10	17.24%
Listening in English	14	24.14%
Writing in English	8	13.79%
Total	58	100%

When answering the question what a technical subject should mainly focus on, 38.33% of students believed a technical terminology should be the main focus (see Table 8). The second largest number of students (35.00%) thought that group projects and discussions should take a lead. A small number (15.00%) of students felt a teacher lecturing had to be a top priority.

Table 8. *What technical subject lessons should mainly focus on*

Answer	Absolute frequency	Relative frequency
Technical terminology	23	38.33%
A teacher lecturing	9	15.00%
Group projects and discussions	21	35.00%
Other	7	11.67%
Total	60	100.00%

Table 9 shows that 40% of teachers thought that they needed to improve English. 46.67% of teachers felt that they would benefit from some training, nevertheless, only 13.33% of them answered they did not have to improve their English skills.

Table 9. *Teachers' needs for the improvement in the English language*

Answer	Absolute frequency	Relative frequency
Yes (I need to improve it)	6	40.00%
No (I do not need to)	2	13.33%
I might benefit from some training	7	46.67%
Total	15	100.00%

Table 10 indicates that a majority of respondents (73.33%) supposed that planning and teaching a technical subject in English required more time than teaching the subject in the native language. Additionally, 20.00% thought that it required the same time and only 6.67% felt that teaching in English involved less time.

Table 10. *Teachers' opinion on what lesson planning and teaching a technical subject in English involves*

Answer	Absolute frequency	Relative frequency
More time than teaching the subject in the native language	11	73.33%
Less time than teaching the subject in the native language	1	6.67%
The same time than teaching the subject in the native language	3	20.00%
Total	15	100.00%

Table 11 illustrates that a considerable number of respondents (73.3%) reckoned that the methodology of teaching a technical subject in English was the same as when teaching a technical subject. However, 26.67% of teachers admitted that they used a different methodology.

Table 11. *Teachers' opinion on the methodology of teaching a technical subject in English*

Answer	Absolute frequency	Relative frequency
A different methodology than a technical subject teaching	4	26.67%
The same methodology as a technical subject teaching	11	73.33%
Total	15	100.00%

5.3 Analysis of answers to open questions

This chapter will focus on the open questions and responses to them. It aims to analyse the respondents' statements[15] (see Appendices 3 and 4), and consequently discuss the benefits and potential limitations of implementing CLIL in engineering courses. The purpose of the analysis is to present the answers, comment on them and point out the teachers' and students' opinions. Then, practical suggestions and recommendations will be considered to improve CLIL methods at technical universities.

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[15] Students' and teachers' answers to open questions were transcribed verbatim, including grammatical and spelling errors the respondents made.

5.3.1 Students' answers to open questions

When asked about the benefits of learning a technical subject in English, students' answers to the open questions were often quite similar, while answers to the other questions were rather short, such as "I cannot", "English" or "Vocabulary". According to some students, learning a technical subject in English contributes to the acquisition of technical terminology and the development of academic writing and speaking skills (see Examples 1–4).

(1)   *Vocabulary, academic English including grammar features and style of writing, presentation skills (use of specific language to talk about narrowly targeted phenomena).*

(2)   *The vast majority of technical data, documentation and discoveries are in English. Understanding the terms in such cases makes it easier to access more information more quickly.*

(3)   *Usually, additional materials regarding the subject on the internet are in English. Therefore, you don't have to struggle with vocabulary, since you have been taught in English already. Also, there are often only a few materials in Czech language available, especially regarding complicated topics.*

(4)   *Standard industry terms that any professional in your field will understand, allowing you to both explain and learn from others in a way that is mutually easy to parse. Improving your English is also a generally good thing to do in a field that is English-dominated.*

According to answers (see Appendix 3), it can be seen that the majority of students shared the same opinion, i.e. they believed that it was much easier to look for information in English, as Examples 5 and 6 illustrate.

(5)   *Usually, additional materials regarding the subject on the internet are in English. Therefore, you don't have to struggle with vocabulary, since you have been taught in English already. Also, there are often only a few materials in Czech language available, especially regarding complicated topics.*

(6)   *The vast majority of technical data, documentation and discoveries are in English. Understanding the terms in such cases makes it easier to access more information more quickly.*

Besides, students also highlighted the importance of learning technical subjects in English that is a lingua franca of science and technology, (see Example 7).

(7)   *Improving your English is also a generally good thing to do in a field that is English-dominated.*

For comparison, some students were convinced that they learned less information than in their native language as their answers in Examples 8, 9, 10 and 11 suggest.

(8)   *It may be harder or take longer to understand concepts compared to learning them in your main language. You may not know a critical word or phrase, and taking time to look it up divides your attention and may make it hard to follow the rest of the conversation/lecture.*

(9)   *You are, at the same time, not learning any terminology in your mother tongue and, thus, might be at a disadvantage in the future. Furthermore, the level of actual technical knowledge learned highly depends on the English level of the lecturer and their ability to express and transfer their knowledge in English."*

(10)   *The level of English can be poor and the vocabularies provided can be inadequate to comprehend the subject properly in both languages. This is the opinion that I hold less often, when lecturers happen to speak in a way where we struggle to understand them.*

(11)   *1) You don't understand what is being said (language barrier), 2) teacher is having trouble speaking correct English, forgetting words, etc.*

Answers to Question 3B in Appendix 1 show that a considerable number of students struggle with a language barrier, saying that English is not their mother tongue, and they focus on the new words rather than a topic (Example 12). Another group of students admitted that it was harder to comprehend the information due to the teacher's proficiency in English (Example 13). There was also a small number of students who responded that English was the preferred language, not considering that they can learn less unless their English level is not high enough, as Example 14 illustrates.

(12)   *It can be harder to understand given topic because of lack of vocabulary.*

(13)   *Teachers are not usually native speakers and their level of english language can affect their ability to explain the subject.*

(14)   *Not true, English is my preferred language of study and communication.*

When asked if students would like to learn only from English technical books, most of their answers could be divided into two groups (see Examples 15–19).

(15)   *No, sometimes is good for understanding basic principles to learn the matter from technical books in native language and afterwards learn the vocabulary in english technical book, because some things could be lost in translation. Many students, who learned only from english technical books, did not undestand what was the subject about.*

(16)   *No, in most subjects it makes no sense. Majority of technical teachers have worse english than we do (grammar mistakes, sentences that makes no sense..). I would like to learn from videos made by actual experts that CAN speak/explain things in english well.*

(17)   *No, I am still Czech citizen Who is going to work probably with Czech speaking collegues. I need to know Czech technical terms so I could be able to communicate with them effectively.*

(18)   *Yes, I think it's important to take the opportunity to learn the English you will need before you get into an industry environment. At this stage of your education, your English should be competent enough to understand the course material.*

(19)   *Why not? When the subject is taught in English, why would I learn from different language text book. Also, for future work, if you want to work abroad, is better to have expirience with terminology.*

A half of the students did not see a point in learning only from English technical books, as it is important for them to have an interaction with a teacher, as Example 20 demonstrates. Another reason for not wanting to learn solely from English technical books was that some students preferred having an explanation in their mother language (from a teacher or a textbook), showed in Example 21. A small number of respondents would prefer learning from videos.

Another half of the students, who chose learning from English technical books, mentioned that learning from different textbooks is beneficial, especially if they plan on working in a foreign country. Moreover, they mentioned that since H-AEI is an English study programme

and the subjects are taught in English, it is convenient to have a written explanation (however, preferable in both languages – English and Czech), as Example 22 indicates.

(20)   *No, because live interaction with a teacher is always better to gain understanding.*

(21)   *Yes but it should contain Czech equivalents of the used English terms for better understandability and clear distinctiveness between similar terms.*

(22)   *I believe, since it is an English course, it is relevant to learn only from English literature. That being said, it seems also relevant to be provided with and maybe focus on the translation of the most important terminology - to know it both in Czech and English."*

Question 9 referred to the form of a technical subject exam, asking whether students prefer to take an examination in a written form, oral or both (Examples 23–29). Surprisingly, most students would prefer to take both written and oral exams. In their opinion, this form of testing is the most effective, as it makes a student properly understand a subject from different areas, as Examples 26–29 suggest.

(23)   *Written exam, because it is easier to gather my thoughts when I have time to do so.*

(24)   *I feel like written exams are generally better for a technical profession, but particularly for ESL people, because they may lack confidence when speaking due to concerns about their accent, which may cause nervousness and hurt their exam scores, thereby not painting an accurate picture of what they know.*

(25)   *Written exam is Fine, but oral can also work. Most often depends on subject. Btw. Programing on paper is in my opinion stupid.*

(26)   *B - As sometimes understand given topic well enough but it can be difficult to answer on a specific topic. With technical subjects the deeper understanding of topic is more important and it is hard to simplify it to fit question in an written exam.*

(27)   *Both. They both test understanding of the subject as well as the ability to be understood in the area of expertise. The majority of teamwork is done spoken to other team members or others, while writing is useful for reports and such. So*

both skills are necessary.

(28)　*Both. Some topics can be better described by oral means. However, this is highly individual and some subjects are less suitable for oral exam (e.g. Maths).*

(29)　*I find that a combination of written and oral examination works best. This type of exam could look like this: you are given a set of examples/cases to go through and prepare on your own at home before the oral exam. In the actual oral exam you then draw one of those examples, show how it is to be calculated and by additional theoretical questions from the lecturer, you show that you have the understanding as to why and how you approached the solution of the example/case.*

Example 30 shows that some students appreciate getting feedback rather than getting a mark without knowing what they did wrong. 13 students selected a written exam because in their opinion it gives them more time to gather thoughts and think about the task under stress (Example 31).

(30)　*I would love to have a feedback with discussion (alongside the teacher) about my answers, even if this part would not influence the final mark (maybe except for E/F results).*

(31)　*A - I feel it easier to express myself in written form when it comes to technical subjects.*

Regarding the oral exams, only 4 students chose them as a preferable way of examination. The most common explanation for it was that it is not only a legitimate way to master the knowledge, but it also enables to develop the speaking skills (Example 32).

(32)　*Oral because it really tests your knowledge.*

According to the students' answers to Question 10, most students shared their opinion on the advantages of learning a technical subject in English (see Examples 33–36).

(33)　*Learning technical subjects in English is extremely valuable on the job market, as being able to work in multi-cultural environments (where English is used on a daily basis) can help you stand out on the job market immensely.*

(34)　*English is lingua franca, and it is so ever more in tech. Subjects taught in English widen the possibilities in terms of future self-improvement in the topic.*

(35) *Getting fluent in the lingo during your studies, so you can immediately utilize it when you start working in a relevant field.*

(36) *You can look up so many sources online, compared to czech.*

Overall, the biggest advantages of learning a technical subject in English are: 1) knowing a technical subject in English boosts students' employability in foreign companies. Therefore, their salary can be higher, as one student explained in Example 37; 2) there is a lot of information on the Internet in English, so it enables students to study faster (Example 38); 3) students learn the English terminology, which can lead to being bilingual at school and work, as Example 39 shows.

(37) *The biggest advantage is the opportunity of using/applying/sharing that knowledge internationally. It is easier to find jobs as many now require some level of international cooperation and it is also easier to search for any additional data/information.*

(38) *The presence of English as lingua franca in many technical fields, it is easy to find additional materials I can use for my studies."*

(39) *It allows you to enter discourse for your subject on international level and opens up more options for further study such as courses/books in English etc.*

Students were asked about the biggest problems in learning a technical subject in English in order to improve the quality of this programme in the future (see Examples 40–44).

(40) *If people are behind in their English, they will fall even further behind in their studies and have significant issues completing their courses.*

(41) *The amount of people fluent in English in academic environments can still be rather low outside of people that specialise in English language. There can also be a certain level of unwillingness to teach the subject in English if the teachers think or know the majority of their students understand Czech.*

(42) *Poor level of English with some teachers, Czenglish in terminology (which can cause some major misunderstandings).*

(43) *Sometimes the difference between technical terminology in English and Czech is very specific and requires to be memorized on top of the sole learning material. This may lead to some confusion / more time-consuming learning curve.*

(44)   *Phenomena that would be hard to be explained in Czech, are even more difficult to understand when explained in a foreign language.*

The questionnaire survey revealed that the biggest problems with learning a technical subject in English were a language barrier for the students' and the teacher's level of English (Examples 45 and 46). Teaching and learning complex concepts and issues seem to be difficult for teachers and students whose English level is low, which makes both teaching and learning much more difficult. Therefore, students as well as teachers who teach a subject in a foreign language are expected to have a good command of English.

(45)   *Teachers – in my experience their level of English was very low.*

(46)   *Quite strong prerequisites in English knowledge are required to even get going and be successful.*

Students were also asked to recommend how lessons in technical subjects in English could be improved. Examples 47–51 indicate that most students pointed out that teachers failed to present information in English properly due to their bad pronunciation and limited English vocabulary, in particular the lack of technical terminology.

(47)   *First and foremost, I believe that there needs to be a sufficient level of English knowledge before attempting to study anything else in that given language (both on the students and lecturers' side).*

(48)   *By using more English in the lessons, or by training some of the teachers to improve their English. Maybe also by translating the textbooks to English, because it is confusing and difficult to prepare for an English exam for an English subject using a textbook in Czech.*

(49)   *Actually having them in English with people who can teach them in English. Having a lesson in Czech with "English textbook to read at home" is not what I'd consider studying in English as I'd argue this is required for those studying in Czech anyway.*

(50)   *Ensure that the instructors themselves are good at English, have an easily understandable accent, and can spell every important word correctly to alleviate confusion.*

(51)   *Improve the qualification of the professors, they are responsible for the courses.*

It was also suggested for teachers to have the textbooks in English or in both languages, English and Czech. Since the students are supposed to do all the exams in English, it would be more accessible and easier for students to prepare and study from the textbooks that are in English (see Example 52).

(52)   *By using more English in the lessons, or by training some of the teachers to improve their English. Maybe also by translating the textbooks to English, because it is confusing and difficult to prepare for an English exam for an English subject using a textbook in Czech.*

Lastly, the students were asked about their favourite subject. Overall, many students mentioned such subjects as HVDE, HDOM, HANA and HSIS (see Examples 53–58).

(53)   *HDOM - Excellent explanation by Doc. Šteffan. VDE - Interesting and practical subject.*

(54)   *HVDE was quite fun, the teacher was amazing and the things we were learning were interesting - still, I hated the formulas part, it makes no sense for us to learn that.*

(55)   *HDOM and HARS - perfect balance between English language and deep dive into the tech aspect.*

(56)   *HANA was a fine subject. The teacher had perfect English slides prepared for each lecture and tought us some Czech terminology as well.*

(57)   *Signals and Systems - Clear structure of the subject. Many materials for practice Great presentation skills of the lecturer.*

(58)   *Signals and Systems (the professor is great, everything was explained in understandable way).*

Students described that the subjects were well structured, teachers presented a lot of materials and explained them in a professional way (Example 59). The other reasons why the above-mentioned subjects were liked best was the teachers' level of English. As the answers to Question 12 were commented, a lot of students of the H-AEI study programme think that the teachers of technical subjects should improve their English. However, the exceptions were the teachers of the subjects HVDE, HDOM, HANA and HSIS, as Example 60 illustrates.

(59) *HVDE, because the topics were interesting, the teacher was knowledgeable and had a friendly approach. Moreover, we were able to use our knowledge in a group project, which also prepared us for the state exam by having us present to project in front of an audience.*

(60) *Formerly HANA, which had a lecturer (prof. Brzobohatý) with a very high level of English and it also focused on technical vocabulary + the problematic areas of using "Czenglish" :-) Also H-EFE and H-EIT, which were usually very interactive and fun to take part in.*

5.3.2 Teachers' answers to open questions

Asking teachers about their experience in teaching a technical subject in English (see Appendix 4) revealed that they had different teaching experience. In fact, all 12 respondents had been teaching for a different period of time, and the length of their teaching experience varied from two to thirty years (see Table 12).

Table 12 also illustrates the number of subjects the teachers taught in English. It shows that teachers taught from one to three technical subjects in English. The most common answer was one or two years. Consequently, a few respondents taught three subjects in English and only one respondent taught five to ten subjects using the CLIL methodology.

Table 12. *The length of teaching experience and the number of subjects taught through the CLIL methodology*

Teacher	Length of teaching experience	Number of teaching subjects
Teacher 1	20	3
Teacher 2	6	1
Teacher 3	15	3
Teacher 4	5	1
Teacher 5	5	2
Teacher 6	5	2
Teacher 7	20	3
Teacher 8	3	2
Teacher 9	2	1
Teacher 10	7-8	2
Teacher 11	7	3
Teacher 12	8	Between 5 and 10
Teacher 13	~30	2

Teachers were asked about students being able to learn more information when a technical subject is taught in English (see Examples 61–63).

(61)   *They combine gained information and knowledge in both languages.*

(62)   *I see the main benefit in the fact that it is much easier to find out more information using English phrases. These are almost exclusively available in English in our area of interest.*

(63)   *Widely/internationally used terms related to a specific subject are used. The English is more common in a technical field.*

According to the teachers' answers, a student can learn more because there is more information in English. Besides, it is not complicated to find this information since there are different textbooks, YouTube channels and technical blogs, as Example 64 describes.

(64)   *While popular books are usually translated, the majority of quality information for technical subjects, specifically around IT, are in English. Including individual YouTube/video science communicators, online blogs, etc. In addition, English proficiency for work is nowadays a requirement to work on an international company – the sooner the students learn the idioms used in their field, the better.*

Besides, there was the same question but a different condition – why students learn less information in a foreign language (see Examples 65-67).

(65)   *It is harder to understand technical principles when a foreign language is used. Descriptions of some circuit principles are complicated to understand, even in the native language.*

(66)   *Understanding some themes can be more difficult in a foreign language and is more time demanding.*

(67)   *They need more time to understand.*

Nearly every teacher mentioned a language barrier or that students did not have a high level of English (Example 68). In their opinion, it is harder and more time-consuming to learn a technical subject in a foreign language than in the native language, as Example 69 shows.

(68)   *Sometimes it is necessary to dedicate more time to the explanation because besides technical misunderstanding also the language problems can occur.*

(69)   *Mastering a subject in both languages takes more time.*

The tenth question was about whether teachers use only English technical books for teaching a technical subject in English or not (see Examples 70-73).

(70)   *Yes. Mainly because the information is in English as well as being more clear not mixing up languages.*

(71)   *Predominantly I do. However, I provide also materials in Czech for better understanding of the issue.*

(72)   *Yes. English is the language of electrical engineers worldwide.*

(73)   *Yes, I do. Most of the books and scientific articles are in English.*

Primarily, most teachers use textbooks in English (Example 74). However, some of them implement the text in Czech to explain the topic more clearly and in greater detail (Example 75).

(74)   *Yes. Mainly because the information is in English as well as being more clear not m ixing up languages.*

(75)   *Basic materials are in English. However, students have the option of working with their Czech equivalents.*

Questioning teachers about what type of exam must students take in a technical subject, most respondents answered that they preferred written exams. However, a few teachers chose an answer "both" without explaining why (see Examples 76–80).

(76)   *Written. The exam includes exercises and also the theoretical questions combining both languages (or translation of the terms). However, I consider the oral exam in the future.*

(77)   *Written, oral project defense to prove they can explain what they have done and why.*

(78)   *Written. To guarantee to fair grading.*

(79)   *Written. Writing requires good knowledge and orientation in the subject.*

(80)   *Written (most of them preffer it).*

It was important to find out what teachers mainly focus on when preparing materials for teaching a technical subject in English. Most teachers explained that clarity, comprehensibility and accurate and consistent terminology were crucial aspects, as Examples 81–85 illustrate. Another frequent answer was focusing on both the technical aspects of the subject and the English language (Examples 86 and 87).

(81)   *Clarity and intelligibility.*

(82)   *Clarity of concepts and structure of the information.*

(83)   *Consistent terminology.*

(84)   *Comprehensibility and clarity of the presented issue.*

(85)   *Clearness, clarity, unambiguity.*

(86)   *To be precise from both technical and language point of view and to provide always the most actual information.*

(87)   *I am focusing only at technical part of subject, for creating an examples exercise, all information are typically in English language.*

Teachers were asked what is the most beneficial for the students who learn a technical subject in English. As expected, most teachers mentioned the advantages of acquiring specialized terminology in English and a better understanding of the subject content in both languages (Examples 88–91). They also highlighted that it is highly beneficial to learn a technical subject in English since not only will the students become bilingual, but it will also allow them to find a well-paid job in multinational companies worldwide (Example 92).

(88)   *They can integrate with foreign students, they become familiar with terminology, they easily can continue with self-study.*

(89)   *All datasheets and technical information are in English, if they learn technical subject in English they can handle all information much more effectively.*

(90)   *Bilingual understanding and knowledge the issue.*

(91)   *They learn technical problems and English at the same time. Training of technical English. They learn the vocabulary from the given branch of the study and after that it is easier for them to read technical papers which are mostly in English.*

(92)   *They possibilities in the future will be higher (e.g. employment).*

The last question was about the least beneficial factor when students learn a technical subject in English. Overall, most of the answers were similar. The English language might present some limitations for students, e.g., not understanding all the concepts correctly or missing important information (Examples 93–96). Besides, mastering a complex topic in a foreign language is challenging and time-consuming. Therefore, it requires much patience and practice to study a technical subject in English, as Examples 96 and 97 indicate.

(93)   *Their lack of knowledge of the language, as it slows them down.*

(94)   *The students find it more difficult and therefore they rather prefer to learn it in Czech.*

(95)   *The student has to be more concentrated. If not he/she miss information easily.*

(96)   *For some students is hard to understand the English so the solving of the problem during lesson can take much more time, than explaining the given problematic in native language.*

(97)   *Mastering a subject in both languages takes more time.*

5.4 Pedagogical implications and recommendations for CLIL in engineering courses

This chapter aims to give recommendations on how teaching a technical subject through CLIL could be better integrated into the curriculum, and how students could learn efficiently in a foreign language. In the theoretical part of this thesis, several types of teaching methods and approaches in CLIL were mentioned. This is why the main objective of this chapter is to discuss the problems, which the students and teachers mentioned, and consequently, to show how these models of CLIL can be easily implemented.

According to teachers (see Chapter 5.3), many students have issues with the English language. Most students have a certain language barrier and as a consequence, need more time to understand what a teacher is explaining in a foreign language.

Even though it is understandable that it is the student's job to develop their English language skills, it is as much the teacher's task to guide the student. That is where scaffolding, the teacher's support provided temporarily in different ways, plays an important role. For instance, if H-AEI students lack some English technical terminology, H-AEI teachers can show students how to acquire it. Students should take crash courses to improve their English, read extra information in English by translating it into Czech, practise grammar, watch YouTube videos or even listen to podcasts, as Ramsay (2020) suggests. Each student might have different issues – one student might have excellent reading skills but struggles with understanding English in real life. For this reason, there is no perfect solution for every student, and a teacher might need to personalize their guidance and scaffolding for particular students. Long's (1996) interaction hypothesis suggests that a teacher's help and encouragement are essential for a student in the long run.

Another element that could be integrated is the interdisciplinary connection (Chapter 2.4). It is an approach that involves two or more CLIL teachers to planning various aspects of the same topic together. In our case with students having a language barrier, this approach could benefit by reason of having a more structured curriculum. This approach is indeed time-consuming and requires a great amount of effort; however, there would be a lot of advantages for students. With having a planned curriculum, teachers could focus solely on hard CLIL (focus on the subject content that is taught in a foreign language) instead of implementing only soft CLIL (its main focus is the study of a foreign language, while the subject content is secondary). To make it clearer, with a planned curriculum students would use more

English and have fewer language barriers, and teacher would be able to explain the subject content without having to pause on some English words that students are not familiar with.

On the other hand, students' comments (see Appendix 3) that even though their programme is in English, they would welcome the textbooks both in the English and Czech languages for better explanation and understanding suggest that a variety of educational materials and resources in education is decisive (see e.g. Mehta, n.d.).

It might be recommended to double-question the decision of studying a subject in a foreign language if one's language level is not high enough; however, there is an approach for those who have already decided to study a subject in a foreign language. It is suggested to adopt Coyle et al. (2010) teaching method, especially in the foreign language learning model.

As Kraucher notes (2021, August 4), a native language might be the language of learning since having learning materials in a native language would help students to understand a topic more clearly. Therefore, English is the language through learning, i.e. through active foreign language use. Also, once a student memorizes the issue in the native language, it makes studying in a foreign language more accessible since it is unreasonable to try to remember all information in English (especially if a student has a language barrier) when a student does not understand it in their mother tongue. Therefore, with progressive learning (from the Czech to the English language), a student would gradually start using English as the language through learning. The language through learning is the language triptych concept (see Chapter 2.3.1), which means that a student is able to use the information in the textbooks in a foreign language without translating it into a mother language.

However, teachers were not the only ones who mentioned the student's language barrier. Students also commented on the teacher's difficulty to use the correct English terminology and using Czenglish[16] instead. As shown in Table 9, 46.7% of teachers answered they might benefit from some training. The teachers who teach different subjects through the CLIL methodology might take an official English language exam (e.g. Cambridge English exam) in order to assess their ability to communicate effectively with students. Moreover, it is worth trying to provide English courses at BUT with particular emphasis on pronunciation with the teacher's busy schedule taken into consideration. Lastly, educational workshops

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[16] Czenglish, a portmanteau of the words Czech and English, refers to the interlanguage of English heavily influenced by Czech pronunciation, vocabulary, grammar or syntax spoken by learners of English as a second language (Lambert, 2018).

could be organized at BUT where the teachers who teach through CLIL could share personal experience, help each other and discuss any problems they encounter when working.

6 Conclusion

The bachelor's thesis had two main objectives. The first objective was to introduce the CLIL method developed by David Marsh and to show how it is possible to integrate CLIL easily. The second objective was to conduct research focused on CLIL in engineering courses of the H-AEI programme at BUT. This programme uses the CLIL concept; therefore, the thesis dealt with the advantages and disadvantages the implementation of CLIL involves. The practical part of the thesis discussed the questionnaire survey results and then provided recommendations for incorporating the CLIL concept to improve the quality of engineering courses.

Studying the relevant sources providing information on CLIL has made writing the theoretical part of the thesis accessible and smooth. CLIL has drawn from diverse theoretical concepts and tailored its methodologies to meet the needs of 21st-century learners. CLIL is a technique that integrates cultural, political and social factors and the changing needs of learners into its framework, as well as language and content teaching. Although it shares some features with other bilingual programmes, approaches to language learning, and content-based language teaching, there are identifiable capabilities that characterize CLIL as an effective method.

As the literature review suggested, CLIL is an educational approach, a generic umbrella that covers a number of applications in exclusive instructional contexts with different targets and learners with different desires and age groups. This variety and versatility in its application are inherent in CLIL as an approach that rejects the prescriptive methods of the last century.

Nevertheless, it is essential to observe that CLIL is an approach whose well-described key concepts distinguish it from different practices. CLIL aims to:

- admire multilingual teaching philosophies,
- deal with language, content, communication, context, and cognition as an inseparable unified entity,
- create naturalistic learning environments,
- offer tasks that inspire cognitive engagement and creativity,
- allow joint creation of information,
- encourage dialogic interaction,
- develop awareness of self and others.

However, it should be noted that CLIL is an evolving educational approach, and its practice is not without troubles and controversies. CLIL additionally has its very own limitations, which are not regularly acknowledged but which can be starting to emerge and which factor to theoretical and methodological shortcomings. CLIL learners can also additionally have unbalanced language.

CLIL is considered as a "two-for-the-price-of-one" concept (e.g. Dalton-Puffer, Nikula & Smit, 2010; Bruton, 2013). To answer Smith's (2005, January 21) question, "So why are we witnessing this quest to use a foreign language as the medium of instruction – trying to make the unnatural natural?" and explain why using CLIL is natural, the thesis covered all the necessary information for a clear understanding of CLIL and showed that if appropriate CLIL implementation with a decent CLIL strategy is chosen, then this methodology might be nothing but outstanding.

The practical part of my bachelor's thesis focused on CLIL in technical subjects at Brno University of Technology. There were two questionnaires presented – one for the students who study electrical engineering study programmes, and one for the teachers of the technical subjects. The main objective of the research was to discuss research findings that proceed from the questionnaire results and suggest how the CLIL methodology could be enhanced to improve the quality of education. However, there were limitations during the process of conducting research, such as not enough respondents on the student's side because of the ongoing accreditation of the H-AEI programme. Moreover, time constraints made the data collection process rather difficult. Despite several setbacks, I was still able to meet the objectives of the research and collect enough data for the analysis. The research results have led to the following conclusions:

- Students struggle with general and technical English; thus, it limits them during their studies.
- Not every teacher provides enough scaffolding, ergo students might not understand the reasons for their struggle and how to improve ~~it~~ their learning.
- There is a limited number of textbooks in both English and Czech languages. Students mentioned that they would welcome equivalents in their first language.
- Teachers use Czenglish instead of applying the accurate technical terminology in English.

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- Lastly, the curriculum needs some improvements. It was recommended to implement interdisciplinary teaching and learning, as the teachers and students could benefit from it. Having a solid CLIL strategy depends on the overall quality of education.

Finally, I hope that the research findings and their analysis provided valuable insight for the students and teachers. There always were and will be personal issues or struggles one may experience because both studying in CLIL and teaching through CLIL are challenging. Nonetheless, even by adopting a few recommendations, it could provide changes for the better in the future. Despite this, it should be noted that after graduating from the H-AEI programme, students have many career opportunities in the Czech Republic and other foreign countries. Moreover, they finish the programme with a comprehensive overview of linguistics and electrical engineering, which makes them valuable workers at any firm.

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List of abbreviations

BPC-ELM – Electrical Machines

BPC-MSE – Measurement in Electrical Engineering

CBL – Case-based learning

CLIL – Content and language integrated learning

CMI – Computer Managed Instruction

EMI – English Medium Instruction

ESL – English as a second language

H-AEI – English in Electrical Engineering and Informatics (study programme abbreviation)

HANA - Analog Technology

HARS – Network Architecture

HBEN – Business English

HDOM – Digital Circuits and Microprocessors

HEFE – English for Engineering

HEIT – English for IT

HELE – Electrical Engineering

HESO – Electronic Devices

HKSY – Communication Systems

HPOP – Computers and Programming

HSIS – Signals and Systems

HVDE – Electrical Power Production and Distribution

IBSE – Inquiry-Based Science Education

MOI – Medium of Instruction

PA – Practical English

ZDP – Zone of Proximal Development

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Appendices

Appendix 1: CLIL questionnaire for H-AEI students

1) Do you have a certificate in the English language?
A) No
B) Yes (Please, tick one or more options below.)
a) State maturita in English
b) Bachelor's degree in   English
c) Master's degree in English
d) Doctoral degree in English
e) Cambridge English: Preliminary
f) Cambridge English: First
g) Cambridge English: Advanced
h) Cambridge English: Proficiency
i) Other(s) (specify which):
……………………………………………………………………………………………..

2) Learning a technical subject[17] (e.g. HDOM, HESO, HPOP, HARS, HVDE) in English helps you to develop
A) language skills
B) subject knowledge
C) both language skills and subject knowledge
D) neither language skills nor subject knowledge
E) other (specify)
……………………………………………………………………………………………..

3) When a technical subject is taught in English, you can learn
A) more information than in your native language because

……………………………………………………………………………………………..
……………………………………………………………………………………………..
B) less information than in your native language because

……………………………………………………………………………………………..
……………………………………………………………………………………………..

4) In technical subjects lessons you
A) speak only English
B) speak about 70 % of the lesson time English and 30 % Czech
C) speak about 50 % of the lesson time English and 50 % Czech
D) speak about 30 % of the lesson time English and 70 % Czech

5) In technical subject lessons, you would like to spend more time
A) speaking in English
B) reading in English
C) listening in English
D) writing in English

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[17]   The technical subjects in English are those taught by teachers who are from other departments than the Department of Languages (ÚJAZ). They do not include English for Information Technology and English for Engineers.

6) Technical subject lessons should mainly focus on
A) technical terminology
B) a teacher lecturing
C) group projects and discussions
Other (specify): …………………………………………………………………………

7) Would you like to learn only from English technical books, coursebooks and other texts in technical subjects you attend?
A) Yes
Give reasons why:
……………………………………………………………………………………………..
B) No
Give reasons why:
……………………………………………………………………………………………..

8) What type of exam would you prefer to take in your technical subjects in English?
A) written exam
Give reasons why:
……………………………………………………………………………………………..
B) oral exam
Give reasons why:
……………………………………………………………………………………………..
C) both written and oral exam
Give reasons why:
……………………………………………………………………………………………..

9) What is the biggest advantage in learning a technical subject in English and why?
……………………………………………………………………………………………..
……………………………………………………………………………………………..
……………………………………………………………………………………………..

10) What do consider the biggest problem in learning a technical subject in English and why?
……………………………………………………………………………………………..
……………………………………………………………………………………………..
……………………………………………………………………………………………..

11) How could lessons in technical subjects in English be improved?
……………………………………………………………………………………………..
……………………………………………………………………………………………..
……………………………………………………………………………………………..

12) What technical subject in English did you like best and why?
……………………………………………………………………………………………..
……………………………………………………………………………………………..
……………………………………………………………………………………………..

Appendix 2: CLIL questionnaire for technical subjects teachers

1) Do you have a certificate in the English language?
A) No
B) Yes (Please, tick one or more options below.)
a) State maturita in English
b) Bachelor's degree in English
c) Master's degree in English
d) Doctoral degree in English
e) Cambridge English: Preliminary
f) Cambridge English: First
g) Cambridge English: Advanced
h) Cambridge English: Proficiency
i) Other(s) (specify which):
……………………………………………………………………………………..

2) How long have you been teaching through content and language learning (CLIL), i.e. teaching a technical subject in English?
……………………………………………………………………………………..

3) How many technical subjects do you teach in English?
……………………………………………………………………………………..

4) Do you think your English language skills need improvement to teach a technical subject in English?
A) Yes
B) I might benefit from some training.
C) No

5) Lesson planning and teaching a technical subject in English requires
A) more time than teaching the subject in the native language
B) less time than teaching the subject in the native language
C) the same time as teaching the subject in the native language

6) Teaching a technical subject in English requires
A) a different methodology than a technical subject teaching
B) the same methodology as a technical subject teaching

7) When teaching you
A) speak only English in lessons
B) speak about 70 % of the lesson time English and 30 % Czech
C) speak about 50 % of the lesson time English and 50 % Czech
D) speak about 30 % of the lesson time English and 70 % Czech

8) Teaching a technical subject in English helps to develop students'
A) language skills
B) subject knowledge
C) both language skills and subject knowledge
D) neither language skills nor subject knowledge
E) other (specify) ……………………………………………………………………..

9) When a technical subject is taught in English, students can learn
A) more information because
…………………………………………………………………………………………………..
…………………………………………………………………………………………………..
B) less information because
…………………………………………………………………………………………………..
…………………………………………………………………………………………………..

10) Do you use only English technical texts for teaching a technical subject in English?
A) Yes
Give reasons why:
…………………………………………………………………………………………………..
B) No
Give reasons why:
…………………………………………………………………………………………………..

11) What type of exam must students take in your technical subject in English?
A) written exam
Give reasons why:
…………………………………………………………………………………………………..
B) oral exam
Give reasons why:
…………………………………………………………………………………………………..
C) both written and oral exam
Give reasons why:
…………………………………………………………………………………………………..

12) What do you focus mainly on when preparing materials for teaching a technical subject in English?
…………………………………………………………………………………………………..
…………………………………………………………………………………………………..

13) What is most beneficial for the students who learn a technical subject in English and why?
…………………………………………………………………………………………………..
…………………………………………………………………………………………………..

14) What is least beneficial for the students who learn a technical subject in English and why?
…………………………………………………………………………………………………..
…………………………………………………………………………………………………..

Appendix 3: Students' answers to open questions

Question Number	Open questions and students' answers
3	When a technical subject is taught in English, you can learn
	A) more information than in your native language because
Student 1	*You're learning the principles of the subject and terms in language which is foreign for you.*
Student 2	*Leaning scientific terminology in English gives you wider understanding of a subject and a much bigger leeway for potential self-study.*
Student 3	*I learn the additional vocabulary and have an easier time looking for additional material. This is the opinion I hold in general about technical subjects.*
Student 4	*I cannot.*
Student 5	*I also develop a technical vocabulary that is very useful when working in global environment.*
Student 6	*Googling terms in English you start digging into the topic, comparing to the native language.*
Student 7	*Gives you better overview of the topic and makes it easier to find other study material*
Student 8	*General words/terms which are used even in the Czech language when describing. Technical phenomena.*
Student 9	*Less technical information, more of English vocabulary.*
Student 10	*For the past 5-7 years most of my studies have been in English rather than in my native language. Thus, I can better orient in English (with English terms and names) without having to translate into my native language.*
Student 11	*English terminology.*
Student 12	*English is a lingua franca.*
Student 13	*English…*
Student 14	*Depends, usually, the language skills of the tutors are on elementary school level.*
Student 15	*Because of specific terminology is used, you will learn how to use it. But other then that, it is a bit difficult to understand than in your native language.*
Student 16	*As most research articles are also in English therefore you have deeper understanding of given topic.*
Student 17	*English vocabulary used in the field.*
Student 18	*Maybe some new words. Problem is, that a quite a lot of teachers of technical subjects aren't that good in English. Lessons with them are painful...*
Student 19	*You often use internet to translate unknown words, it often gives us more details and descriptions of it.*
Student 20	*You may be more used to the English vocabulary.*
Student 21	*You learn the English discourse for the subject which you can utilize internationally.*
Student 22	*You learn it in basically two languages.*
Student 23	*You have to pain more attention to the words being said to fully understand.*
Student 24	*You also get to expand the specific vocabulary of that given subject.*
Student 25	*Vocabulary, academic English including grammar features and style of writing, presentation skills (use of specific language to talk about narrowly targeted phenomena).*
Student 26	*More universaly accepted terminology and concepts.*

Student 27	*Vocabulary.*
Student 28	*The vast majority of technical data, documentation and discoveries are in English. Understanding the terms in such cases makes it easier to access more information more quickly.*
Student 29	*There are more materials available.*
Student 30	*There are materials written in English on the internet.*
Student 31	*Technical knowledge in English, and I believe that knowledge of English terminology should be included even in non English taught courses.*
Student 32	*Standard industry terms that any professional in your field will understand, allowing you to both explain and learn from others in a way that is mutually easy to parse. Improving your English is also a generally good thing to do in a field that is English-dominated.*
Student 33	*Some materials such as datasheets are available only in English, many terms come from English so it makes more sense sometimes.*
Student 34	*New words, it is more fun to learn it in English.*
Student 35	*Usually, additional materials regarding the subject on the internet are in English. Therefore, you don't have to struggle with vocabulary, since you have been taught in English already. Also, there are often only a few materials in Czech language available, especially regarding complicated topics.*
3	When a technical subject is taught in English, you can learn
	B) less information than in your native language because
Student 1	*1) You don't understand what is being said (language barrier) 2) teacher is having trouble speaking correct English, forgetting words, etc.*
Student 2	*learning is more time-consuming due to language barrier.*
Students 3–4	*Language barrier.*
Student 5	*its harder to properly understand every sentence while keeping the focus on the technical topic.*
Student 6	*It may be harder or take longer to understand concepts compared to learning them in your main language. You may not know a critical word or phrase, and taking time to look it up divides your attention and may make it hard to follow the rest of the conversation/lecture.*
Student 7	*It can be harder to understand given topic because of lack of vocabulary.*
Student 8	*I focus on new words.*
Student 9	*Learning tech subject in English provides better comprehension of tech related English vocabulary.*
Student 10	*I don't think you learn less. Unless you struggle with English language itself.*
Student 11	*English is not my mother tongue language.*
Student 12	*English and knowledge from that technical subject. Quality of that really depands on teacher.*
Student 13	*English…*
Student 14	*Because you are not able to understand 100 %.*
Student 15	*Because lack of terminology knowledges at first, it is difficult to comprehend information, however, it became better with time.*
Student 16	*Although it's fun, it's kinda hard. We are not getting deeper into the themes.*
Student 17	*I do not think that it has any down sides, in case that the teacher and students are proficient enough in English. Sometimes missing vocabulary in second language can be an issue(but very easy fix).*

Student 18	*Less native language terminology that might be missing in the future.*
Student 19	*No.*
Student 20	*You might struggle in the beginning with the terms, also not all teachers were proficient enough in the English language to truly be efficient.*
Student 21	*You may not understand some words.*
Student 22	*You may not necessary understand the topic well because of your level of English*
Student 23	*You may not fully grasp more detailed concepts of your study material depending on your language level.*
Student 24	*You don't understand it.*
Student 25	*You are, at the same time, not learning any terminology in your mother tongue and, thus, might be at a disadvantage in the future. Furthermore, the level of actual technical knowledge learned highly depends on the English level of the lecturer and their ability to express and transfer their knowledge in English.*
Student 26	*The scope of the subject is extended which leads to extra time required for completing it within the curriculum.*
Student 27	*There is still a slight limitation in understanding English is a second language.*
Student 28	*Teachers often stutter when they have to describe complicated phenomenons.*
Student 29	*Teachers have difficulty finding the right terms (or words for description of how devices function) and my native language is easier for me to comprehend.*
Student 30	*Teachers are not usually native speakers and their level of English language can affect their ability to explain the subject.*
Student 31	*Sometimes you understand high-level context, do not go deeper to understand and learn smth imprecisely.*
Student 32	*Sometimes you are not familiar with the terms.*
Student 33	*Sometimes it is more difficult to understand the topic in foreign language such as English.*
Student 34	*Not true, English is my preferred language of study and communication.*
Student 35	*The level of English can be poor and the vocabularies provided can be inadequate to comprehend the subject properly in both languages. This is the opinion that I hold less often, when lecturers happen to speak in a way where we struggle to understand them.*
8	Would you like to learn only from English technical books, coursebooks and other texts in technical subjects you attend? A) Yes. B) No. Give reasons why:
Students 1–9	*Yes*
Students 10–11	*No.*
Student 12	*Yes, I think it's important to take the opportunity to learn the English you will need before you get into an industry environment. At this stage of your education, your English should be competent enough to understand the course material.*
Student 13	*No because lectures are more interesting.*
Student 14	*No because it would be good to see the equivalent words in Czech.*
Student 15	*No, a lot of technical topics is best described and explained with visual aid, such as videos,*
Student 16	*I would say that as bilingual students we should benefit from both English sources but also from our Czech/Slovak ones.*

Student 17	*B) The more you read about the subject from different sources, the more diverse knowledge you get.*
Student 18	*B) I would prefer to be given the materials ideally in both languages to be able to pick which materials I study with better, and to be able to properly translate technical texts after graduating and in professional context.*
Student 19	*A) Yes, I find them more suitable for our studies.*
Student 20	*A) Why not? When the subject is taught in English, why would I learn from different language textbook. Also, for future work, if you want to work abroad, is better to have experience with terminology.*
Student 21	*A) I believe, since it is an English course, it is relevant to learn only from English literature. That being said, it seems also relevant to be provided with and maybe focus on the translation of the most important terminology - to know it both in Czech and English.*
Student 22	*B) I like to combine English material with Czech material as it is still important to me to be proficient in my field in my native language.*
Student 23	*No, I am still Czech citizen Who is going to work probably with Czech speaking colleagues. I need to know Czech technical terms so I could be able to communicate with them effectively.*
Student 24	*No, because live interaction with a teacher is always better to gain understanding.*
Student 25	*No, in most subjects it makes no sense. Majority of technical teachers have worse English than we do (grammar mistakes, sentences that makes no sense..). I would like to learn from videos made by actual experts that CAN speak/explain things in English well.*
Student 26	*Yes, it helps.*
Student 27	*Yes, I prefer the materials in English.*
Student 28	*Yes, in case the materials are sufficient for obtaining the credit. This is not the case for me personally, therefore I used other sources to learn and practice for subjects.*
Student 29	*Yes, but with mandatory Czech translations and knowledge.*
Student 30	*Yes but it should contain Czech equivalents of the used English terms for better understandability and clear distinctiveness between similar terms.*
Student 31	*No, I need an explanation in my mother tongue.*
Student 32	*No, this is quite inefficient for People like myself who prefer other types of learning.*
Student 33	*No, speaking and using language in practice is everything.*
Student 34	*No, sometimes it's useful to have a Czech equivalent - for example in labs, the exercise materials were available in both languages, which was great.*
Student 35	*No, sometimes is good for understanding basic principles to learn the matter from technical books in native language and afterwards learn the vocabulary in English technical book, because some things could be lost in translation. Many students, who learned only from English technical books, did not understand what was the subject about.*
Student 36	*No, some phenomenons are too complex to be explained in English only.*
Student 37	*No, it is better to have both English and our native language sourcebooks so we can compare translation and understand it properly.*
Student 38	*No, the language is much more complex than that. You need linguistic classes for that.*

9	What type of exam would you prefer to take in your technical subjects in English?
	A) written exam because…

Student 1	*Written - I need more time to think about the answer.*

Student 2	*Based on projects, partially maybe written exams.*
Student 3	*A) you can think more about your answer.*
Student 4	*A) written exam, I prefer them in every subject, I feel like I have more time to think about my answers.*
Student 5	*A) Since they're easier for me.*
Student 6	*A) More comfortable.*
Student 7	*A) I feel like written exams are generally better for a technical profession, but particularly for ESL people, because they may lack confidence when speaking due to concerns about their accent, which may cause nervousness and hurt their exam scores, thereby not painting an accurate picture of what they know.*
Student 8	*A) I feel it easier to express myself in written form when it comes to technical subjects.*
Student 9	*A) because these topics are more difficult to talk about when under stress.*
Student 10	*A written, because usually it is simpler*
Student 11	*Written exam, because it is easier to gather my thoughts when I have time to do so.*
Students 12–13	*Written.*
9	What type of exam would you prefer to take in your technical subjects in English? B) oral exam because…
Student 14	*B because it helps develop your language skills along with speaking and technical knowledge.*
Student 15	*B - As sometimes understand given topic well enough but it can be difficult to answer on a specific topic. With technical subjects the deeper understanding of topic is more important and it is hard to simplify it to fit question in an written exam.*
Student 16	*Oral because it really tests your knowledge.*
Student 17	*Written exam is Fine, but oral can also work. Most often depends on subject. Btw. Programming on paper is in my opinion stupid.*
9	What type of exam would you prefer to take in your technical subjects in English? C) both written and oral exam because…
Student 18	*Both. Both are equally important.*
Student 19	*A) Would be lazy and maybe easier one, because you can sometimes remember a lot C) For me personally it's better, because I'm not nervous during oral exam, and you can sometimes justify your answer even thought when teacher thinks it's wrong.*
Student 20	*Both. Some topics can be better described by oral means. However, this is highly individual and some subjects are less suitable for oral exam (e.g. Maths).*
Student 21	*Both, written helps to memorize stuff and oral examinations are useful for the state exam.*
Student 22	*I would prefer only written, its obviously the easiest, however objectively speaking combination of written and oral will make us study properly.*
Student 23	*Both. They both test understanding of the subject as well as the ability to be understood in the area of expertise. The majority of teamwork is done spoken to other team members or others, while writing is useful for reports and such. So both skills are necessary.*
Student 24	*C) More variables (language disciplines, academic discipline content) lead to more precise evaluation of knowledge.*

Student 25	*C) It should be both to properly test your knowledge.*
Student 26	*C) I find that a combination of written and oral examination works best. This type of exam could look like this: you are given a set of examples/cases to go through and prepare on your own at home before the oral exam. In the actual oral exam you then draw one of those examples, show how it is to be calculated and by additional theoretical questions from the lecturer, you show that you have the understanding as to why and how you approached the solution of the example/case.*
Student 27	*C. However, mostly from translation, rather than technical stuff.*
Student 28	*C), I would love to have a feedback with discussion (alongside the teacher) about my answers, even if this part would not influence the final mark (maybe except for E/F results).*
Students 29–35	*Both.*
10	**What is the biggest advantage in learning a technical subject in English and why?**
Student 1	*You have the knowledge in English. You can work for large companies and travel for work.*
Student 2	*Knowledge of professional terms. Nowadays, most bigger companies are international.*
Student 3	*It is easier to understand English tech videos, manuals written in English etc.*
Student 4	*It is easier to put the knowledge to use since English is used everywhere nowadays.*
Student 5	*I think of it as learning in Czech and in English at the same time, since in many subjects we speak both languages. I think the biggest advantage is that you learn more in less time.*
Student 6	*It allows you to enter discourse for your subject on international level and opens up more options for further study such as courses/books in English etc.*
Student 7	*Improvement in English (technical vocabulary).*
Student 8	*Higher amount and variety of available materials, in comparison with Czech language.*
Student 9	*Language enhancement.*
Student 10	*Having professional knowledge be easily accessible by already knowing prerequisite industry terms is a significant advantage.*
Student 12	*General words/terms which are used even in the Czech language when describing technical phenomena.*
Student 13	*English terminology - being able to work abroad in this field of expertise.*
Student 14	*English is world-wide language so not only majority of research articles are in English but for future job it's better to study in English for more job opportunities.*
Student 15	*English is lingua franca, and it is so ever more in tech. Subjects taught in English widen the possibilities in terms of future self-improvement in the topic.*
Student 16	*Communication with experts from other countries and all around the world.*
Student 17	*Ability to work abroad, as you can have higher salary there.*
Student 18	*Getting fluent in the lingo during your studies, so you can immediately utilize it when you start working in a relevant field.*
Student 19	*Language practice and new terminology.*
Student 20	*Learning technical subjects in English is extremely valuable on the job market, as being able to work in multi-cultural environments (where English is used on a daily basis) can help you stand out on the job market immensely.*
Student 21	*You get better in English - it can help you to find a job in an international technical company.*

Student 22	*You can work abroad.*
Student 23	*You can look up so many sources online, compared to czech.*
Student 24	*You are not limited by the possibilities of your country and you can go global.*
Student 25	*Wider possibility of communication with USA and Britan. But Germans still prefer Germany... and Czechs tend to work quite often in German technical companies.*
Student 26	*Very limited use case only in Czechia, the world is much bigger than our small country.*
Student 27	*There is much more literature and resources available online and offline.*
Student 28	*Learning English.*
Student 29	*The presence of English as lingua franca in many technical fields, it is easy to find additional materials I can use for my studies.*
Student 30	*Provided English and technical spheres are world trends, it is more likely to find employment in different countries regardless of any local language proficiency.*
Student 31	*Opportunity to work with foreign scientists.*
Student 32	*More value in job marketplace.*
Student 33	*Many source materials and scientific articles are in english language. It could be easier to find a job in a different country.*
Student 34	*Majority of the world speaks English so it is better applicable.*
Student 35	*Majority of the products and tech innovations are in English so you can organically understand the context.*
Student 36	*Learning terminology, new words, phrases that you can use for a lifetime.*
Student 37	*The biggest advantage is the opportunity of using/applying/sharing that knowledge internationally. It is easier to find jobs as many now require some level of international cooperation and it is also easier to search for any additional data/information.*
11	What do you consider the biggest problem in learning a technical subject in English And why?
Student 1	*Your poor level of English can be a huge limitation in understanding of the subject.*
Student 2	*Less time to think about obtained information in a moment and language barrier-technical terms are not always understood.*
Student 3	*Language barrier, sometimes it is better to explain the topic of the lecture in native language.*
Student 4	*Language barrier.*
Student 5	*Lack of technical English knowledge on the side of a teacher.*
Student 6	*I see no problems for me.*
Student 7	*Insufficient English level of teachers - its just awful to listen to someone who struggles with basic English.*
Student 8	*If you do not have quite advance tech understanding learning terminology together with learning actually subject is a bit overwhelming.*
Student 9	*Limited number of professionals.*
Student 10	*If people are behind in their English, they will fall even further behind in their studies and have significant issues completing their courses.*
Student 11	*For majority it will be language barrier for some that it can mix with what they have learned previously in high school.*

Student 12	*Difference of used terminology between Czech and English. Some terms can be mischanged for other similar ones.*
Student 13	*Competencies of teachers.*
Student 14	*Can't see any!*
Student 15	*Bad English of teachers and students.*
Student 17	*an approach to us and to those subjects by the teachers.*
Student 18	*I don't know some Czech terms. Also lot of teachers suck in English, and its painfull to pay attention to them. (POV you are Czech student).*
Student 19	*Mathematical computations and too deep knowledges that are not necessary for our program.*
Student 20	*Phenomena that would be hard to be explained in Czech, are even more difficult to understand when explained in a forein language.*
Student 21	*Unknown terminology*
Student 22	*Tutors with bad pronunciation (most of them), people with 5 academic titles who were relevant 30 years ago.*
Student 23	*Translation of some words may be different.*
Student 24	*The teachers. Their English is not good most of the time and the subject can be pretty boring. sometimes we learn totally unnecessary things.*
Student 25	*The potential of not knowing the terminology when working for a Czech company after the studies.*
Student 26	*The amount of people fluent in English in academic enviroments can still be rather low outside of people that specialise in English language. There can also be a certain level of unwillingness to teach the subject in English if the teachers think or know the majority of their students understand Czech.*
Student 27	*That main focus was in trying to teach us technical stuff instead of using English in practice there.*
Student 28	*Technical subjects can be more complex and relatively harder to understand. This influence can be even more impactful when learning your second language (be it English or any other language).*
Student 29	*Teachers - in my experience their level of English was very low.*
Student 30	*Sometimes the terminology and the texts are too complicated to understand at first but I consider that as an opportunity to learn, so it is not an issue.*
Student 31	*Sometimes the difference between technical terminology in English and Czech is very specific and requires to be memorized on top of the sole learning material. This may lead to some confusion / more time consuming learning curve.*
Student 32	*Some information can be lost in translation.*
Student 33	*Requires more time. CBL[18] approach prescribes learning both language and an academic discipline. Hence, there is more to comprehend.*
Student 34	*Quite strong prerequisites in English knowledge are required to even get going and be successful.*
Student 35	*Poor level of English with some teachers, Czenglish in terminology (which can cause some major misunderstandings).*
Student 36	*Teachers that do not know proper English/ do not know how to explain things in English.*

| 12 | How could lessons in technical subjects in English be improved? |

| Student 1 | *More structurised approach, group projects.* |
| Student 2 | *I would like to have materials in mother tongue and English - similar - in order to be sure that I got all the terms and problematics correct.* |

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[18] Case-based learning.

Student 3	*Invite more teachers from different countries which truly understand the subjects.*
Student 4	*Improve the qualification of the professors, they are responsible for the courses.*
Student 5	*Improve English of technical teachers. Combine more Czech and English terms.*
Student 6	*Hire professors that are passionate about their work.*
Student 7	*Higher language proficiency when it comes to teachers.*
Student 8	*First and foremost, I believe that there needs to be a sufficient level of English knowledge before attempting to study anything else in that given language (both on the students and lecturers side).*
Student 9	*Lecturer actually knowing how to speak English.*
Student 10	*Everything is fine by me.*
Student 11	*By using more English in the lessons, or by training some of the teachers to improve their English. Maybe also by translating the textbooks to English, because it is confusing and difficult to prepare for an English exam for an English subject using a textbook in Czech.*
Student 12	*By more understandable explanation of technical terminology.*
Student 13	*By dividing programme on explaining technical stuff and swift main focus on translation to/from English this technical stuff and how it works.*
Student 14	*Better teachers.*
Student 15	*Better pronounciation, more official study materials in English. (less books)*
Student 16	*Be more interactive and visual.*
Student 17	*Actually having them in English with people who can teach them in English. Having a lesson in Czech with "English textbook to read at home" is not what I'd consider studying in English as I'd argue this is required for those studying in Czech anyway.*
Student 18	*Ensure that the instructors themselves are good at English, have an easily understandable accent, and can spell every important word correctly to alleviate confusion.*
Student 19	*Mainly make sure that English proficiency of teachers and students is sufficient.*
Student 20	*More discussion student-teacher, more study materials.*
13	What technical subjects in English did you like best and why?
Student 1	*HDOM[19] - Excellent explanation by Doc. Šteffan. VDE - Interesting and practical subject.*
Student 2	*HDOM because it felt the most natural in English.*
Student 3	*HDOM and HARS - perfect balance between English language and deep dive into the tech aspect.*
Student 4	*Formerly HANA[20], which had a lecturer (prof. Brzobohatý) with a very high level of English and it also focused on technical vocabulary + the problematic areas of using "Czenglish" :-) Also H-EFE and H-EIT[21], which were usually very interactive and fun to take part in.*
Student 5	*Every which is well prepared and has any connection with practical world and field of study of the degree.*
Student 6	*Energy creation.*
Student 7	*Electrical motors.*

[19] Digital Circuits and Microprocessors
[20] Analog Technology.
[21] English for Engineering. English for IT

Student 8	*HDOM, there were really good teacher that didn't have a problem to explain anything in Czech.*
Student 9	*Don't remember the name. Something related to electricity distribution. Cool professor*
Students 10–12	*Do not remember.*
Student 13	*BPC-MSE[22]. The lab exercises were pretty enlightening.*
Student 14	*BPC-ELM [23]even though I have repeated this course after the change of teacher the subject was really good.*
Student 15	*HDOM, HSIS[24], HANA[25].*
Student 16	*HANA was a fine subject. The teacher had perfect English slides prepared for each lecture and tought us some Czech terminology as well.*
Student 17	*HANA, positive approach of the teacher.*
Student 18	*HELE[26] - good teacher.*
Student 19	*HVDE was quite fun, the teacher was amazing and the things we were learning were interesting - still, I hated the formulas part, it makes no sense for us to learn that.*
Student 20	*Unfortunately, I do not remember much of the courses or their content; however, I do remember I liked math quite a lot - we had a great teacher, who spoke perfect English and classes were mostly practical rather than boring theory lectures.*
Student 21	*HSIS, the teacher actually wanted to teach us something and made it fun.*
Student 22	*Signals and Systems (the professor is great, everything was explained in understandable way).*
Student 23	*Signals and Systems, mostly for including the aforementioned glossaries.*
Student 24	*Signals and Systems - Clear structure of the subject. Many materials for practice Great presentation skills of the lecturer.*
Student 25	*Physics because it was the most fun one.*
Student 26	*HESO, because teacher focused both on terminology and technical side of subject.*
Student 27	*Materiály a technická dokumentace, it was fun and practical.*
Student 28	*HKSY[27] so far (hopefully it won't get any worse (I have only begun it); I'd say HDOM too but it was taught in Czech.*
Student 29	*I remember we did some translations in Math, and Electronic parts if I remember correctly. So, those ones because we actually did some translation part there.*
Student 30	*I liked making cool programs in programming because it allowed me to automate everyday tasks for me and other people.*
Student 31	*HVDE, because the topics were interesting, the teacher was knowledgeable and had a friendly approach. Moreover, we were able to use our knowledge in a group project, which also prepared us for the state exam by having us present to project in front of an audience.*
Student 32	*HSIS, enthusiastic tutor with great English.*
Student 33	*Maybe PA[28], or currently BEN[29].*

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[22] Measurement in Electrical Engineering.
[23] Electrical Machines.
[24] Signals and systems.
[25] Analog Technology.
[26] Electrical Engineering.
[27] Communication Systems.
[28] Practical English.
[29] Business English.

Appendix 4: Teachers' answers to open questions

Question Number	Open questions and teachers' answers
2	How long have you been teaching through content and language learning (CLIL), i.e. teaching a technical subject in English?
Teacher 1	*8 years*
Teacher 2	*7-8 years*
Teacher 3	*6*
Teacher 4	*5 years, two lessons per year + seminaries/workshops.*
Teacher 5	*5 years.*
Teacher 6	*~30 years.*
Teacher 7	*3 years.*
Teacher 8	*15 years.*
Teacher 9	*0*
Teacher 10	*20 years.*
Teacher 11	*Regularly last 4 semesters (2 years).*
Teacher 12	*BUT courses, private language schools.*
Teacher 13	*About 5 years.*
Teacher 20	*About 50 years.*
3	How many technical subjects do you teach in English?
Teachers 1–5	*2*
Teachers 5–9	*1*
Teachers 9–14	*3*
Teacher 15	*Between 4 and 10.*
9	When a technical subject is taught in English, students can learn A) more information because
Teacher 1	*Widely/internationally used terms related to a specific subject are used. The English is more common in a technical field.*
Teacher 2	*While popular books are usually translated, the majority of quality information for technical subjects, specifically around IT, are in English. Including individual YouTube/video science communicators, online blogs, etc. In addition, English proficiency for work is nowadays a requirement to work on an international company - the sooner the students learn the idioms used in their field, the better.*
Teacher 3	*They think differently, reveal new relationships.*
Teacher 4	*They learn the terminology that is used worldwide which can be then further used to search for further knowledge.*
Teacher 5	*They combine gained information and knowledge in both languages.*
Teacher 6	*They are forced to orient themselves in the subject in the terminology of both languages.*
Teacher 7	*The terminology is in English anyway.*

Teacher 8	*There is more information in English literature.*
Teacher 9	*There are a lot of materials available in English.*
Teacher 10	*Terminology.*
Teacher 11	*Technical words that are used world-wide (omitting Czech translations).*
Teacher 12	*No difference between Czech and English.*
Teacher 13	*I see the main benefit in the fact that it is much easier to find out more information using English phrases. These are almost exclusively available in English in our area of interest.*
Teacher 14	*From various internet sources.*

9	When a technical subject is taught in English, students can learn A) less information because
Teacher 1	*Understanding some themes can be more difficult in a foreign language and is more time demanding.*
Teacher 2	*They need more time to understand.*
Teacher 3	*They cannot map 1:1 their English understanding with their native mindset. I believe this can pretty much be ignored in practice, but I see a different way of communicating technical subjects among Spanish colleagues at work than when they do in English.*
Teacher 4	*The same response on the same question.*
Teacher 5	*Sometimes their level of English is not sufficient.*
Teacher 6	*Sometimes it is necessary to dedicate more time to the explanation because besides technical misunderstanding also the language problems can occur.*
Teacher 7	*Some materials are not available in English.*
Teacher 8	*Of possible language barrier.*
Teacher 9	*No difference between Czech and English.*
Teacher 10	*Mastering a subject in both languages takes more time.*
Teacher 11	*Many students are not comfortable when speaking English, so they are often shy (or lazy) to ask for help. They also don't understand clearly all the information given.*
Teacher 12	*It is harder to understand technical principles when a foreign language is used. Descriptions of some circuit principles are complicated to understand, even in the native language.*
Teacher 13	*It is harder to explain and understand in a non-native language.*
Teacher 14	*Do not understand the language.*
Teacher 15	*Because are limited by their English.*

10	Do you use only English technical texts for teaching a technical subject in English? Yes/No. Give reasons why.
Teachers 1–3	*Yes.*
Teacher 4	*Yes, Students work only with English terminology.*
Teacher 5	*Yes. Mainly because the information is in English as well as being more clear not mixing up languages.*
Teacher 6	*Yes in majority of cases.*
Teacher 7	*Yes (I have lessons with students not speaking Czech language).*
Teacher 8	*Yes, I do. Most of the books and scientific articles are in English.*
Teacher 9	*Yes, higher availability of actual materials.*

Teacher 10	*Yes, from last year on.*
Teacher 11	*Yes. English is the language of electrical engineers worldwide.*
Teacher 12	*Predominantly I do. However, I provide also materials in czech for better understanding of the issue.*
Teacher 13	*No, identical pages in Czech and English.*
Teacher 14	*In most cases I provide supplement texts in Czech.*
Teacher 15	*Basic materials are in English. However, students have the option of working with their Czech equivalents.*
11	**What type of exam must students take in your technical subject in English? Written/oral/both. Give reasons why**
Teachers 1–5	*Both.*
Teacher 4	*Written. Writing requires good knowledge and orientation in the subject.*
Teacher 5	*Written. To guarantee to fair grading.*
Teacher 6	*Written. The exam includes exercises and also the theoretical questions combining both languages (or translation of the terms). However, I consider the oral exam in the future.*
Teacher 7	*Written, oral project defense to prove they can explain what they have done and why.*
Teacher 8	*Written, oral, practical (programming).*
Teacher 9	*Written (most of them preffer it).*
Teacher 10	*Written (it is more quicker).*
Teacher 11	*Students elaborate the project during the semester where they present something in English. The exam is written.*
Teacher 12	*Only written. Time requirement is one of the reasons.*
Teacher 13	*None, since attendance to the lessons I give are kind of optional.*
12	**What do you focus mainly on when preparing material for teaching a technical subject in English?**
Teacher 1	*Sing correct technical terms.*
Teacher 2	*To cover things (fields) that the course offers.*
Teacher 3	*To be precise from both technical and language point of view and to provide always the most actual information.*
Teacher 4	*The question is somehow misleading. But of course, the teaching materials must be both, correct from technical point of view and also correctly written in English.*
Teacher 5	*Technical content.*
Teacher 6	*Technical aspects, to use more pictures than text wherever possible.*
Teacher 7	*No difference between Czech and English.*
Teacher 8	*I am focusing only at technical part of subject, for creating an examples exercise, all information are typically in English language.*
Teacher 9	*Easy to understand.*
Teacher 10	*Correct grammar and spelling.*
Teacher 11	*Consistent terminology.*
Teacher 12	*Comprehensibility and clarity of the presented issue.*
Teacher 13	*Clearness, clarity, unambiguity.*

Teacher 14	*Clarity of concepts and structure of the information.*
Teacher 15	*Clarity and intelligibility.*

13	What is most beneficial for the students who learn a technical subject in English and why?
Teacher 1	*To be competitive internationally.*
Teacher 2	*They possibilities in the future will be higher (e.g., employment).*
Teacher 3	*They learn the terminology that is used worldwide.*
Teacher 4	*- They learn technical problems and English at the same time.* *- Training of technical English.* *- They learn the vocabulary from the given branch of the study and after that it is easier for them to read technical papers which are mostly in English.*
Teacher 5	*They have no language barriers when studying English books or scientific articles.*
Teacher 6	*They can integrate with foreign students, they become familiar with terminology, they easily can continue with self-study.*
Teacher 7	*They are able to distinguish between different terminologies.*
Teacher 8	*The ability to communicate with foreign partners.*
Teacher 9	*Practice, worldwide used standards.*
Teacher 10	*Learn to thing in English.*
Teacher 11	*Improving English as it is the technical language.*
Teacher 12	*Improved ability to communicate in a globalizing environment.*
Teacher 13	*Bilingual understanding and knowledge the issue.*
Teacher 14	*All datasheets and technical information are in English, if they learn technical subject in English they can handle all information much more effectively.*

14	What is least beneficial for the students who learn a technical subject in English and why?
Teacher 1	*Understanding of the complex issue can be more difficult for the students.*
Teacher 2	*They will not be able to speak Czech about the issue or use correct Czech expressions. But this is a negligible problem nowadays.*
Teacher 3	*They can get lost in translation and misunderstand the subject*
Teacher 4	*The students find it more difficult and therefore they rather prefer to learn it in Czech.*
Teacher 5	*The student has to be more concentrated. If not he/she miss information easily.*
Teacher 6	*Their lack of knowledge of the language, as it slows them down.*
Teacher 7	*Problem of "language barriers" in employment, where the English is not frequently used.*
Teacher 8	*Nothing.*
Teacher 9	*Mastering a subject in both languages takes more time.*
Teacher 10	*I see nothing non-beneficial.*
Teacher 11	*If their level of English is low, they do not learn the technical content.*
Teacher 12	*For some students is hard to understand the English so the solving of the problem during lesson can take much more time, than explaining the given problematic in native language.*
Teacher 13	*Do not know, maybe if they do not have the language background.*