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Breaking the Barriers in Language Learning
New Methods for Engineering Students to Learn Foreign Languages

Lotta Saarikoski [1]
HOD Principal Lecturer
VAMK University of Applied Sciences
Vaasa, Finland
E-mail: lotta.saarikoski@vamk.fi

Sari Isokangas
Senior Lecturer
VAMK University of Applied Sciences
Vaasa, Finland
E-mail: sari.isokangas@vamk.fi

ABSTRACT

Language skills are very important to a global engineer. There are many new ideas and methodologies which can be imported and used in developing the language learning and teaching in engineering education. This paper will focus on Content and Language Integrated Learning (CLIL) and Tandem methods which have been tested in BSc engineering education for several years in Finland at VAMK (Vaasa University of Applied Sciences). Results of these teaching experiments have been good and encouraging. Guidelines for new language teaching methods and curriculum development in engineering education will be given in this paper.

Conference Key Areas: Curriculum Development, Engineering Education Research, Engineering Skills

Keywords: language learning, CLIL, engineering education, Tandem method

INTRODUCTION

One critical skill for an engineer operating in today's global environment is the ability to speak several foreign languages. Therefore, it is important to develop and increase different language learning and teaching methods in engineering education and to shift the focus more to the development of communicative speaking skills and natural language learning. Engineering students' possibilities to learn languages in today's tertiary education are no longer limited to the normal basic language courses and the field-specific language courses – usually referred to as LSP (Language for Specific Purposes) offered by the respective institutions. Participating in foreign-language-medium (hence referred to as FL-medium) degree programs can offer an effective

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[1] Corresponding Author

natural way for language learning if also the linguistic development is kept in mind and supported. Another way to increase the natural language learning and to develop especially the communicative skills is to use the classroom Tandem methodology in the courses or to offer Tandem session possibilities outside the official teaching hours. This works especially well if the university operates in bilingual areas or if there are many foreign students with different mother tongues studying at the university.

This empirical paper describes several *language learning related teaching experiments* conducted in engineering education at VAMK (Vaasa University of Applied Sciences). The aim of the teaching experiments was threefold: first, to develop the language teaching and learning and second, to create new models for natural language learning and third, to improve the engineering students` communicative skills in Swedish which is the other official language in Finland and which language is used very much in the region where the graduating engineers of VAMK will be employed. The local chamber of commerce has supported these teaching experiments and this shows how important engineering students` effective language learning is for the local industry and business life in general.

After presenting the theoretical background in the next chapter, the settings and some findings of the qualitative learning experiments will be presented in chapter 2. Conclusions and new models for language learning and suggestions for the development of the engineering curriculum will be provided in chapter 3.

1 THEORETICAL BACKGROUND

1.1 Learning languages in a natural way – using CLIL

Second language acquisition literature generally divides the nature of language acquisition into two categories related to the learning conditions: Naturalistic (often referred to as *nature*) and instructed (respectively referred to as *nurture*; eg. Mitchell & Myles [1]). Relating to this division we will present the contexts in which the learner in tertiary education faces a foreign language in the following figure 1:
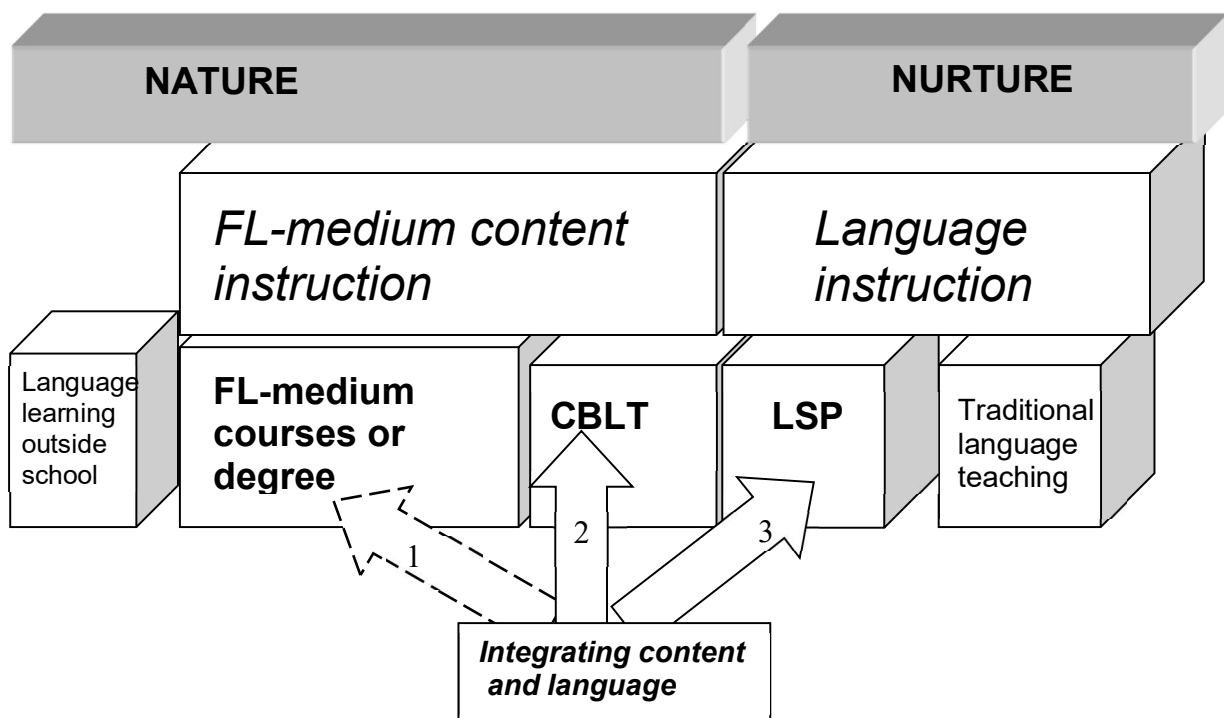
Fig. 1. The spectrum of content and language in tertiary education.

By *FL-medium courses or degree programs* we mean instruction given totally (most typical arrangement) or partially (occasionally) in a foreign language in a professional subject. The starting point in tertiary education when introducing FL-medium courses or degree programs has not usually been primarily to improve the learners' language learning but to boost the international profile of the respective institution, with an aspiration to become part of the international discourse community and to be able to attract more international students. FL-medium instruction could be used as an effective language learning method, too, if used properly and the language learning would be also in the focus of evaluation, even in the subject courses, and not only the subject topic.

CBLT (Content-Based Language Teaching) means typically that a language specialist is also a specialist on a subject-specific topic. The teacher utilizes her expert knowledge (eg. art history) to teach the language – or builds the language course around this expert knowledge. The learners focus on the content and learn the language incidentally, being mainly directed towards learning the content. In higher education the following problem presents itself: a very limited number of language specialists are experts in some other professional content. Perhaps a more realistic option when implementing the CBLT model would be a content teacher who takes a special interest in language development and becomes trained as a specialist in it to some extent. However, the more expertise the knowledge in the chosen subject specific topic requires, the less likely it is that the one and the same person could do both content and language. This is typically the case in higher education.

LSP (language for specific purposes) is a term introduced already in the seventies. It means language classes whose syllabus is closely related to the needs of the learners' future profession – partly intersecting with the concept of CBLT. As an example of this is teaching in English to engineering students using engineering journals, other engineering texts and eg. videos (from the internet) with experts in the field giving presentations. In practice, the use of authentic materials and examples as course materials requires certain co-operation between the content teacher and the language teacher. The element of integrating content with language is thus already built in the structure of LSP courses. The LSP teachers, however, have been faced with the following problem: with the absence of materials and examples from FL-medium content instruction - as not enough such instruction has been available because most content teaching is done in the native language - the language teachers have often had to use simulations and authentic materials from random sources. The idea of integration has been around for the last three decades but surprisingly little seems to be happening even now when more FLM content teaching is provided.

In order to increase natural language learning in engineering education one option is to start integrating content and language. This means introducing the CLIL (Content and Language Integrated Learning) methodology into the engineering curriculum. *"CLIL is a dual-focused educational approach in which an additional language is used for the learning and teaching of both content and language"* [2]. Integrating content and language can be implemented in three different ways (arrows 1,2 and 3 in the figure1). Arrow 1 relates to the possibilities of *integrating language to content* (eg. the language teacher providing vocabulary and other language related help in a FL-medium content course like e.g. Robotics course). An example of this model is given later in this article. Arrow 2 relates to CBLT. This arrangement would be an optimal – although in most cases theoretical – example of content and language integration. Arrow 3 means *integrating content to language* (eg. the lab reports of the physics course would be written in English as part of homework for the English language course).

1.2 Different models of CLIL in tertiary education

As mentioned in the previous chapter, the possibilities of CBLT in tertiary-level context are limited. A more realistic CLIL model in higher education consists of co-operation between the expert in the professional content and the language expert. We present two different models of co-operation possibilities between a content teacher and a language teacher in figure 2:
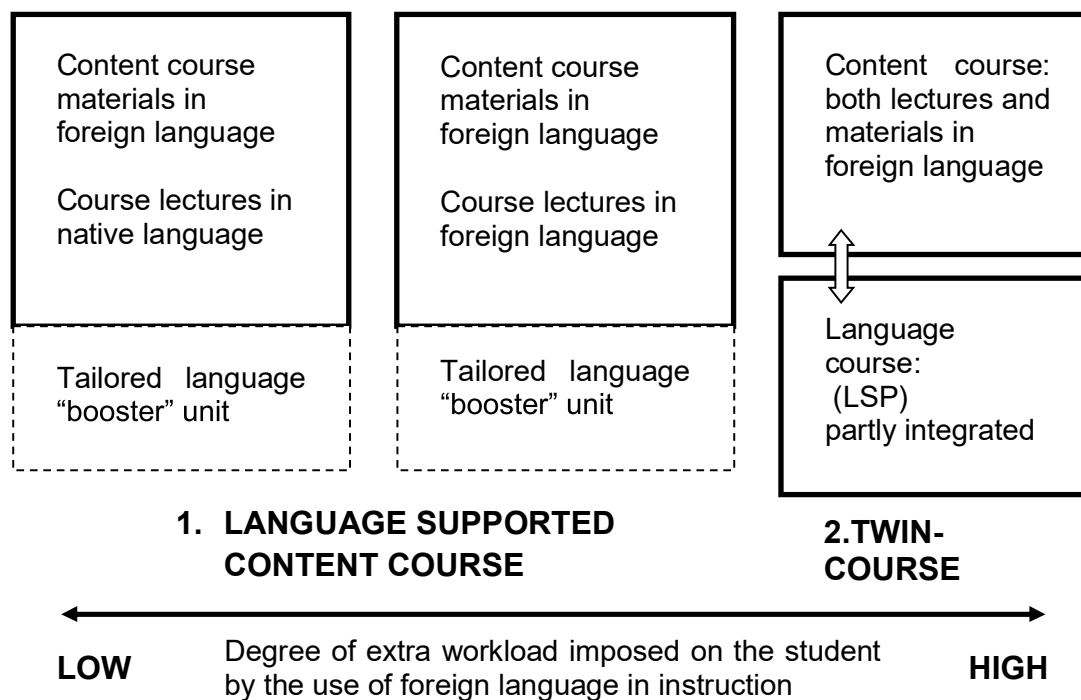
Content course materials in foreign language Course lectures in native language	Content course materials in foreign language Course lectures in foreign language	Content course: both lectures and materials in foreign language
Tailored language "booster" unit	Tailored language "booster" unit	Language course: (LSP) partly integrated

1. LANGUAGE SUPPORTED CONTENT COURSE   **2.TWIN-COURSE**

LOW — Degree of extra workload imposed on the student by the use of foreign language in instruction — HIGH

Fig. 2. Different CLIL co-operation models

A twin-course means a content course which is integrated with an LSP course. A language supported content course means that the content course (instructed totally or partially in foreign language) is supported by a separate language "booster module", instructed by a language teacher. A more detailed example, designed and implemented by the current writers, will be presented in the results section.

1.3 Improving communicative skills using the classroom tandem method

Tandem method in language learning means a learning partnership between two persons with different mother tongues. In tandem the learners work in pairs and they both benefit equally from working together. Their language learning is based on communication between them. The two members in each pair have different mother tongues and the aim in tandem sessions is to learn these two different languages (e.g. a Finnish-speaking Finn learns Swedish and a Swedish-speaking Finn learns Finnish). The pairs talk first e.g. one hour in the mother tongue of one of the members and after that they switch into the other person`s mother tongue for another hour. The both learners are experts of their own language and culture and so they can help each other with the linguistic problems occurred in the conversations [3]. Classroom tandem is used in the school context when students coming from different language groups are being taught together and they study together. The tandem teacher must have a new way of thinking and working habits. A new pedagogical mindset is needed. The teacher must set kind of milestones (tasks) on the map and by reaching these milestones the

targets of language learning will be acquired. The teacher should help the student pairs to find and accomplish these milestones.

In tandem sessions the pairs can choose to read aloud or they can discuss particular topics of interest. They can also correct mistakes and suggest improvements for each other or just practice conversations and do all kinds of other activities which at the university level in the classroom tandem will be prepared by the language teacher. In classroom tandem the role of the language teacher will change from teacher to more of a facilitator and coach. The tasks must be such that space is left for students`own creativity and thinking. In easy subjects free conversations can be used but in more demanding topics more support is needed from the teacher and the tasks must be more structured [4]. Tandem sessions should be made as interesting as possible for the pairs and the session tasks should deal with topics that are of equal interest to both tandem learners. There are two main principles in tandem: reciprocity and autonomy. Reciprocity means that both tandem partners benefit equally from the cooperation and they should work the same amount for both languages. Autonomy means that both of the tandem partners control their own learning: they define their goals and how to reach them, they decide what kind of support they wish to have from their tandem partner and they also evaluate their own achievement. [5]

2   TEACHING EXPERIMENTS

2.1 Description of the teaching experiments in phase 1 - CLIL

Two different types of teaching experiments were conducted during different academic years at VAMK. In the first phase we developed the English language learning and teaching with the CLIL methodology. We used the language supported content course model. In it a special language module was tailored to the content course – on a very practical level, the description below shows the reader that corresponding models could easily be implemented without complex administrative arrangements. The project included classroom teaching and follow-up research, with learner feedback. In *Table 1*, the setting of these teaching experiments is being described.

Table 1. Description of the CLIL experiments

Course	Corporate Planning 42 classroom hours credit: 3 ECTS points (several courses)	Language Support for Corporate Planning 16 classroom hours credit: 1.5 ECTS points (several courses)
Teachers	Content teacher	Language teacher
Learners	$3^{rd \, or \, 4th}$ year mechanical engineering BSc students 40 learners altogether (many groups, during several years)	
Learners' language proficiency level	Heterogeneous groups, proficiency level ranged between A2 to C1	
Responsibility for course materials	Content teacher	
Responsibility for scheduling and assignments	Content teacher	Language teacher
Teaching responsibility	Providing information on theory and practice of Corporate Planning	Providing language support and supervising learners' language production
Language used in teaching	Lectures in Finnish, materials in English	Class room language mainly English, materials in English
Research included in the project	In the beginning of the course: on-line survey and language tests	At the end of the course: on-line survey and language tests

Our follow-up research consisted of an on-line survey where the learners self-rated their language skills and possible changes in these skills and gave feedback on the course. We observed a consequent increase in learner satisfaction, examples of which are given below in table 2, obtained in our survey from our last group.

Table 2. Learners opinions of CLIL

Statement	number of yes answers	total number of answers
Reading the materials was useful from the view point of language learning	13	14
My active vocabulary became somewhat larger	14	14
Reading English texts became somewhat faster	13	14
I would recommend this course to next- year students	14	14

2.2 Description of the teaching experiments in phase 2 – classroom tandem

In the second phase we developed the Swedish language learning and teaching with the classroom tandem methodology. As there are two universities of applied sciences operating with different teaching languages in the same city it was easy to start a project using classroom tandem in two language courses because distances were not a problem. As the university buildings situated even beside each other it was very easy to join student groups with different mother tongues (Finnish and Swedish) from both universities into same classrooms at the same time. The other student group learned Finnish and the other Swedish. *Table 3* describes the settings of the experiment.

Table 3. Description of the classroom tandem experiments

Courses	Communicative Swedish course (free choice voluntary course) 36 + 4 contact hours altogether, 3 ECTS Finnish course (obl.course in the BSc eng. curriculum) 3-5 ECTS
Main responsible lecturers and tasks	A team of two Swedish and Finnish language teachers: content and task planning One teacher from each university with different languages of instruction (Finnish/VAMK and Swedish/Novia) Manager: funding and schedule planning and promotion
Learners (different years different groups)	1st year mechanical and electrical engineering BSc students from the Finnish speaking UAS, 14-21 students per year 2nd year BSc industrial engineering and BSc business students from the Swedish speaking UAS , 16-18 students per year In each Tandem session there were ca. 20 students
Learners language level	Heterogeneous group. Proficiency level ranged between A1 to C1
Language used in the teaching and Tandem sessions	Finnish and Swedish , 5-6 Tandem sessions per student pair a´ 2*45 minutes
Student selection	Ranking test was held before the course started. The weakest and the best ones were excluded from the course
Data collection	Open-ended questionnaire in the end of the course

After the courses an open-ended questionnaire was distributed and answers were collected. The main target of the questionnaire was to find out what the students thought about the tandem method and the sessions. Mainly qualitative data was collected. Most of the students (86-88%) had very positive or positive comments about this method. Only a few students (like 1-2 in a group of 20) had neutral comments and none had negative comments about this method.

The free comments about the tandem course were such as : *good thing, helped me much to develop further, a good way to study as one gets courage to speak and use the other language, it was super good to learn to talk, really good idea, it is a pity that we did not have this method already in the gymnasium, this method should be used in all language teaching and learning, very good and educative, best course in Finnish language ever, good course I like it, really effective course, good experience, really nice way to learn, much nicer than the normal teaching, gave me good social competences, much better way than the traditional Swedish teaching, it has gone well and nice it has been, quite good concept, tandem sessions were very educative and nice, good organization, better than the normal way, interesting experience, more of this thanks, good this forces one to learn.* Almost everybody said that they had become more brave in using the language and in the last group 88% thought that they had learned Swedish language better or much better with this method than with the traditional language teaching.

To summarize, the overall student experience was very good. One very interesting outcome of this experiment was the widening of the students` cultural understanding. Both language groups (Finnish and Swedish speakers) said that they had started to better understand the other language group and their culture and habits as they now for the first time ever in their life (most of them) were in contact with an individual from the other language group. So the students not only learned the other language but they developed their intercultural competences. It might sound strange that even in Finland there are cultural differences between Finnish speaking and Swedish speaking Finns but this is the case. So any method to develop intercultural social skills of the engineering students is beneficial as these students in the future will mainly work in bilingual areas and companies where these skills are highly valued and useful in everyday work.

3   SUMMARY AND ACKNOWLEDGMENTS

The paper has presented several pedagogical experiments conducted in BSc engineering education in Finland where engineering students have been exposed to new language teaching and learning methods based more on natural language learning. Based on the qualitative results there is evidence that this type of natural language learning is beneficial and develops especially the students` communicative competences, linguistic self-esteem and also cultural understanding (especially the tandem method) and teamwork skills in general. Therefore it is strongly recommended that the universities should develop their curriculums and teaching schedules in such a way that the curriculums should include courses where students from different universities with different official languages (such as e.g. minority and majority languages in some area) could study together and work on some common tasks and simultaneously learn languages.

Another suggestion is that in the FL-medium instruction more attention should be payed on the development of the foreign language skills of the student. It seems inevitable that the trend in higher education – and all other levels of education – will be

towards more FL-medium teaching. The challenge for the institutions is to keep up with this trend to maintain their status. The challenge for the language teacher is to accept the possibility of a structural reform of language teaching towards the integration of a language course to content instruction – and for the content teacher to be ready to co-operate with the language teacher – or ideally adopt an additional role as language model or supervisor. The challenge for the managers and decision-makers in institutions of tertiary education is to optimize the new possibilities for maximal language outcome. This can mean e.g. that in engineering degree programs where teaching is done totally or partly in a foreign language (typically in English) the whole curriculum must be changed in such a way that small language booster units joining the subject courses should be inserted into the curriculum.

In order to realize this type of co-operation the teachers from different disciplines (e.g. a language teachers and a subject teacher) should be encouraged to collaborate and also teachers from different universities with different languages also should be encouraged to conduct courses as teams. This can be initiated by common EU or similar projects where extra resources should be given to the developers in the starting phase. Also the organizational culture at the universities should support cross-functional collaboration and collaboration over the language borders, too. It is an imperative for the universities to further develop themselves and become truly international networked learning organizations from the pedagogical point of view, too.

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