IMPLEMENTING CLIL TECHNOLOGY IN THE CONTEXT OF SUPPLEMENTARY EDUCATION FOR SECONDARY SCHOOL STUDENTS AT A TECHNICAL UNIVERSITY

The article describes experience of implementing supplementary educational programmes for secondary school students using CLIL technology at a technical university. CLIL technology is viewed as an integrating tool to develop a set of competences necessary for Learner-Centred Continuing Education of future specialists in the framework of supplementary educational programmes. The paper provides analysis of theoretical prerequisites and practices for the use of Content and Language Integrated Learning Technology in foreign language education. It shows opportunities of integrating them into the supplementary educational process at a technical university in “the secondary school — higher school interaction” context. The subject, meta-subject and personal characteristics of the attainment targets of the training programmes are addressed. The article presents the results of the technology approbation attached to the implementation of supplementary educational programmes for secondary school students at Kalashnikov ISTU.

Keywords: Content and Language Integrated Learning (CLIL), CLIL technology, foreign language communicative competence, subject competence, meta-subject competence, Learner-Centred Continuing Education, supplementary educational programmes, career guidance.

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языковой интегрированной технологии обучения в иноязычном образовании. Показаны возможности их интеграции в процесс дополнительного образования в техническом вузе в контексте взаимодействия субъектов на уровне школа-вуз. Рассматриваются предметные, метапредметные и личностные характеристики результатов освоения программ обучения. Представлены результаты апробации данной технологии при реализации дополнительных образовательных программах для учащихся СОШ в ИжГТУ имени М. Т. Калашникова.

Ключевые слова: технология предметно-языкового интегрированного обучения (CLIL), иноязычная коммуникативная компетенция, предметная, метапредметная компетенция, непрерывное личностно-ориентированное образование, программы дополнительного образования, профессиональная ориентация.

Introduction

Achieving success in the professional area under the conditions of the modern world implies the continuity of skills development and the continuity of the educational process, in particular. Personality formation begins at preschool age and continues throughout a person's life.

The concept of lifelong learning originated in the views of Plato, Confucius, Socrates, Aristotle, L. A. Seneca, Voltaire, J. V. Goethe, J. J. Rousseau, who associated it with the achievement of the full development of a human being as an individual. Therefore, “lifelong learning” may be regarded as the constant improvement of an individual’s knowledge, skills and abilities caused by the need to “keep up with the times”, the desire to be a highly demanded specialist in the existing professional and social environment [Perezhovskaya, 2015]. In the modern world, the need for lifelong learning is due to the progress of science and the widespread use of innovative technologies [Consultant, 2022].

The development programme of Kalashnikov Izhevsk State Technical University (hereinafter referred to as Kalashnikov ISTU) notes that secondary schools and their students have a request for Lifelong Learning (“education throughout life”) and for the development of future specialists as highly-demanded ones in the labour market [ISTU, 2020]. It emphasizes the need to develop supplementary educational programmes (hereinafter referred to as the SEP) for school students so that they can meet the contemporary requirements of the time and make it possible to effectively fill the gaps in training within basic educational programmes at secondary educational institutions. Moreover, SEP must be designed to provide school students with high-quality preparation to be able to get enrolled into the universities in the future.
It is also important to note that the supplementary education of children is aimed at developing their creative abilities, satisfying their individual needs for intellectual, moral and physical improvement, as well as organizing their free time. Supplementary education ensures children’s adaptation to life in society, their career guidance, as well as the identification and support of children who have demonstrated outstanding abilities [Consultant, 2022]. Subsequently, we have a reasonable ground to point out that supplementary education contributes a lot to the concept of Learner-Centred Continuing Education.

In this respect, the approach to carrying out supplementary educational courses, accepted by the Scientific and Educational Center “Innovation Technologies in Language Professional Education” of Kalashnikov ISTU (hereinafter referred to as SEC), seems to be highly profound and effective. The prospective idea of the SEC activities is to develop a system of continuous multi-level education ranging from supplementary education for school students to higher education and supplementary professional education for adults [ISTU, 2020]. One of the current SEC objectives that lends support to the overall systemic approach is to implement pre-university preparatory courses and supplementary education programmes for secondary school students of grades 6–11, aimed at developing their personal, meta-subject and subject competences.

According to the National Curriculum of Secondary Education the competences mentioned above are associated with the results of mastering the basic educational programme by school students and may be characterized as follows:

1. **Personal competence**, including the students’ readiness and ability for self-development and personal self-determination, the formation of their motivation for learning and deliberate cognitive activity, a system of meaningful social and interpersonal relationships, value-semantic mindset that reflect personal and civic positions in the course of activity, the ability to understand Russian civil identity in a multicultural society.

2. **Meta-subject competence**, including inter-subject concepts mastered by students, and universal study skills (regulatory, cognitive, communicative), the ability to use them in cognitive and social practice, learner autonomy in both planning and doing educational activities, independence in organizing teachers-to-student cooperation as well as peer-to-peer cooperation, the ability to build up an individual educational trajectory, mastering research skills, project-based and social activities.

3. **Subject-based competence**, including skills that are specific to the subject area mastered by students in the course of studying the subjects, types of activities to obtain new knowledge within the framework of
a subject, its transformation and application in educational and social project situations, the formation of a scientific way of thinking, knowledge of scientific terminology, key concepts, methods and techniques [Garant, 2012].

The competences under consideration may serve as attainment targets and indicate efficiency level of the supplementary educational programmes provided.

It's also notable that the supplementary educational courses carried out by the SEC for school students are focused on preparing for further professional education, on developing students’ individual abilities through a deeper mastery of a foreign language (than that provided for by the basic course at school) related to having a good command of other subject areas. The principle of integration of the subject and language components of education, adopted as the basis of education, involves the formation of comprehensive ideas about the world and general culture of students, the development of systemic scientific knowledge and activity methods on a meta-subject basis. All of the above features of school students’ supplementary education reflect the essence of the Content and Language Integrated Learning Technology used in the framework of supplementary educational programmes at the SEC of Kalashnikov ISTU.

Methods

The review of the articles devoted to continuing education and vocational-oriented foreign language learning [Krylov, Halyapina, Arkhipova, 2021; Arkhipova, 2014] confirmed the fact that modern educational institutions in Russia widely use an integrated subject-language approach (Content and Language Integration or CLIL) at both the secondary school and university levels. Moreover, since 2010, CLIL has been recognized in all European Union countries as the main recommended method of teaching English at schools, including supplementary education programmes. Why is this approach so popular?

First of all, due to globalization and modern conditions of development of foreign language education in the world, this approach has become the basis of technology of bilingual Content and Language Integrated Learning (CLIL). The term CLIL was first introduced by D. Marsh in 1994 and it was he who pointed out that CLIL is relevant in case when subjects or certain topics within the subjects are taught in a foreign language pursuing two objectives at a time: learning the content of this subject along with simultaneous learning of a foreign language [Coyle, Hood, Marsh, 2010].

Having analyzed the papers [Baïdak, Mínguez, Oberheidt, 2005; Coyle, Hood, Marsh, 2010; Salekhova, Grigorieva, Lukoyanova, 2020] de-
voted to the CLIL research and methodology more than 40 definitions of CLIL were found: firstly, as a concept in which a foreign language acts as a learning tool, secondly, the use of CLIL is aimed at achieving two goals: the study of both the subject content and the foreign language itself. Nevertheless, the definition given by D. Marsh most completely reveals the essence of this approach [Marsh, 2012].

Thus, CLIL is a range of methods aimed at formation of students’ communicative and subject competences in a foreign language in the same educational context in parallel with shaping and developing general and subject knowledge and skills in their native language.

The foundation of CLIL is the unity of “4 C” as the integration of 4 main components: Content, Communication, Cognition, Culture, which was developed by Professor D. Coyle in 1999, and implies combining the study of subject content, language within a certain context, situation, and defines the interaction of the components in class as follows [Coyle, Hood, Marsh, 2010]:

1. **Content** — the subject or topic the curriculum is based on (history, mathematics, geography, economics, etc.).
2. **Communication** — the language we learn the subject in and master in the process of learning.
3. **Cognition** — thinking operations that help to understand the reality.
4. **Culture** — the way we interact with realities and apply our knowledge and skills in life.

It should be mentioned that the effectiveness of CLIL learning is achieved through [Coyle, Hood, Marsh, 2010]:

- consistently mastering certain amount of knowledge, skills and understanding of the content;
- inclusion in cognitive processes;
- communicative interaction in a certain context;
- development of linguistic knowledge and speech skills;
- cultural identity.

Following D. Marsh [Mehisto, Frigols, Marsh, 2008] we believe that a number of key CLIL principles contributes to effective implementation of training:

1. **Focus of training in different areas that includes:**
   - learning some language phenomena in various subjects;
   - learning the subject content at foreign language lessons;
   - integration of several subjects;
   - inter-subject links within the training process;
   - reflex-based learning process.
2. Enriching atmosphere of the learning process that consists of:
   - introduction and presentation of language and subject information during the lessons;
   - developing students’ confidence in language practice and subject knowledge;
   - evaluation of students’ use of authentic materials;
   - improving students’ language skills.

3. Authenticity that means:
   - increasing the students’ interest;
   - continuous involvement of learners into the learning process;
   - use of new relevant materials from media, books, Internet resources.

4. Active learning:
   - students learn and practice the subject information through interaction doing professionally oriented tasks;
   - students assess their learning and development progress;
   - peer co-learning;
   - discussion the importance of learning the language and the subject simultaneously;
   - teachers act as mentors and/or assistants.

5. Scaffolding:
   - organization of training on the basis of knowledge, skills, interests and experience of students;
   - using various ways of study;
   - development of creativity and critical thinking.

6. Collaboration:
   - joint planning and implementation of lessons in a pedagogical tandem (a language teacher and a subject teacher, and/or an invited foreign specialist — university teacher);
   - involving parents in the learning process which includes explaining the curriculum and the ways to support students.

It is worth noting the meta-subject approach to learning as a condition for the success of the educational process, which involves:

- ensuring the child’s overall cultural, personal and cognitive development and learning abilities;
- understanding of the necessary concepts of the subject, formation and further development of students’ subject basic abilities, use of the method of rediscovery of knowledge in different educational material, use of reflex [Deykova, 2019].
In this study, we take a look at the SEP “English Summer School “UPSTREAM” for school students of grades 6-11 as an educational platform where educational, didactic and developmental tasks are interrelated. The educational activity of the ESS is based on the CLIL: a foreign language is used as a means of understanding the training content. Upon completion of the ESS, students successfully enroll in annual English language courses. They can choose from a wide variety of courses run by the University, e.g. “English for Specific Purposes (Science, Engineering, Technology and Mathematics)” course.

While learning a foreign language, school students focus on such fields of science and technology as mathematics, physics, information technology, robotics, instrumentation, biotechnology, digital linguistics, and the basics of intercultural communication.

It should be noted that in the SEP diverse forms of organizing classroom activities are applied such as:

1) business and interactive games, discussions, quizzes, puzzles, project work;
2) quests (for example, a plot-based quest, a quest containing a set of tasks using mobile technologies, including qr-codes);
3) excursions to specialized laboratories of the university and workshops run in English. (Studying modules that relate to physics and mathematics, students visit the Non-Destructive Testing Laboratory, where they get acquainted with X-ray, acoustic and thermal control devices, make measurements, make and submit a report in English under the supervision of their instructor);
4) interactive activities such as a round-table discussion, a debate contest, a speaking club, a press conference run by foreign experts.

Some of the above-mentioned sessions were conducted by a biotechnologist from the Republic of India, Ph.D., Assistant Professor of robotics from the University of Damascus from the Syrian Arab Republic, experts in the field of intercultural communication from the Republic of Ghana and the Federal Republic of Nigeria. The school students received a unique experience of communication with foreigners in English, applying the knowledge of intercultural professional communication acquired in the SEP classes.

When developing the content of the classes, the “4 Cs” principle of the CLIL technology was taken into account. An example of the implementation of the “4 C” principle when studying the topic “Robots in our life” is presented in Table 1.
Table 1. Example of implementing of “4 C” principle

<table>
<thead>
<tr>
<th>Content</th>
<th>Communication</th>
<th>Cognition</th>
<th>Culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robots in our life</td>
<td>a) Brainstorming “What are the key characteristics of a robot system?”</td>
<td>a) <strong>Recall</strong> three phrases that relate to the topic;</td>
<td>The attitude towards technology in various countries.</td>
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<td></td>
<td>b) Project “Building robots for the future”</td>
<td>b) <strong>Guess</strong> the type of a robot;</td>
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<td></td>
<td>c) Discussion “Robots in our life: a disruptive or creative force”</td>
<td>c) <strong>Design</strong> a new robot that you want to see in the future;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d) Role game “Introduction with a computer scientist innovator”</td>
<td>d) <strong>Predict</strong> what will happen if robots replace people;</td>
<td></td>
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<tr>
<td></td>
<td>e) Press conference with a scientist “Will robots have an impact on our life”</td>
<td>e) Read the title the text, and <strong>predict</strong> the content and outcome of the text;</td>
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<td></td>
<td>f) <strong>Discuss</strong> the writer’s purpose in writing this text, the examples (evidence, data) the author brings in to illustrate each of his ideas;</td>
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<td></td>
<td>d) <strong>Analyze</strong> the ideas you are skeptical about or/and the ideas that resonate with you.</td>
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</tbody>
</table>

While running SEP for school students one should take into account their age and personality traits, which can be achieved by organizing small groups of learners and designing learning materials for students with different levels of English.

It is worth emphasizing the peculiarity of the course for school students — teaching mixed groups (groups of students of different ages — 12–16 years old, with different levels of English). Special attention should be drawn to the personalized approach in terms of rigorous selection of didactic content, designing activities and educational material to the target group, which causes certain difficulty. Due to the abundance of the material, it can be difficult to keep the students focused and interested in full.
Despite the difficulty, teachers participating in the educational process of ESS contribute to their professional development. Studying authentic literature, exchanging experience with colleagues, working in tandem with an expert in a particular field, collaborating with foreign experts, designing an e-course in the LMS Moodle and preparing worksheets — these are the components of teacher professional development that result in success of ESS.

As for the language of instruction, in CLIL a foreign language is considered to be a core skill that allows language-proficient students to develop professionally oriented communicative skills and abilities, meta-subject and subject competences.

Thus, the description and definition of CLIL provided above plays a crucial role in the light of the changes taking place in modern education and society in general, as well as in the context of continuing education. Consequently, we may assume that CLIL technology will serve as an effective means of developing a set of key competences, which are vital for continuous education of future specialists, in the context of supplementary education at a technical university.

Results

In this section, special attention should be paid to the outcomes of implementing supplementary educational programmes such as “English Summer School “UPSTREAM” (hereinafter referred to as the ESS) and “English for Specific Purposes (Science, Engineering, Technology and Mathematics)”, which combine both general educational and pre-professional aspects of education. During the educational process, along with the language training, students receive additional knowledge that helps them decide on their future professional field of activity.

In order to identify the level of acquired meta-subject, subject and foreign language communicative skills (“hard and soft skills”), a series of diagnostic testing and surveys of students were carried out annually.

Testing and surveys were aimed at identifying the level of foreign language training before and after the course.

When considering the development of foreign language communication skills (the education results of groups taught in the 2021–2022 academic year are presented in Fig. 1), we can distinctly observe positive dynamics in the development of skills and abilities of the main types of speech activity, in particular, receptive reading and listening skills, the development of a professionally oriented subject vocabulary, as well as productive speaking skills. To a lesser extent, writing skills and grammatical skills are formed, since in CLIL more attention is paid to the
subject and meta-subject aspects of learning. In addition, the removal of psychological barriers in communication is of high priority.

The annual survey was held among the learners to find out the level of their soft and hard skills developed. Here is a fragment of the survey containing the relevant questions:

**What results have you achieved by the end of the Summer School? (more than one answer is possible)**

a) development of creative abilities  
b) development of critical thinking skills, memory and attention  
c) development of communication skills  
d) the ability to analyze and solve problems  
e) the ability to work in a group, interact with peers  
f) mastering English  
g) gained confidence in speaking English  
h) overcame the fear of communicating in English with foreigners

**What English language skills has the English Summer School helped you develop? (more than one answer is possible)**

a) subject vocabulary  
b) listening comprehension  
c) speaking
What subject areas would you like to study in depth (multiple answers are possible)

- a) programming
- b) robotics
- c) instrumentation
- d) biotechnology
- e) reading and understanding popular science texts
- f) writing skills

The findings of the survey of 88 respondents on SEP for the four year period are presented in Fig. 2.

Analyzing the data presented, it should be noted that there is a significant decline in all indicators of the development of personal “soft” skills in 2021 compared to 2018 and 2019. The negative trend is mainly due to the transition to online learning at schools and lockdown during the COVID-19 pandemic in 2020 (in 2020, ESS was not conducted due to the pandemic, data are not available).

Due to the end of the lockdown in 2022 after COVID-19 and the transition to traditional education at schools and courses the educational
process had a positive effect. In order to increase the effectiveness of SEP education in 2022 much attention was paid to adapting the content of the training programme to the age, psychological and pedagogical characteristics of students and the development of foreign language communication skills.

The responses, related to their desire to study in depth relevant subject areas (see Fig. 3), show an increased demand for information technology, artificial intelligence and robotics (more than 80% of responses demonstrate a higher priority given to the subject areas mentioned, compared to the results of the previous years of study), which corresponds to the demand in modern society, including that among school students. According to the survey findings, the study of a foreign language, English, in particular, is in great demand as well.

Our study has also brought the following points to the foreground. The students of the courses, provided by the SEC of Kalashnikov ISTU, are highly motivated to study the demanded subject areas; they are capable of reflection and are aware of the fact that the integration of foreign language competence with the knowledge of relevant technical sciences (robotics, information technology, artificial intelligence, etc.) ensures their successful employment in the future.
Judging by the results of the surveys we can conclude that the data obtained demonstrate a positive trend in the development of subject, meta-subject and foreign language communicative competences during the period of study at the SEP courses at Kalashnikov ISTU.

**Discussion**

A four-year experience in conducting supplementary educational programmes, as well as positive feedback from the students and their parents, allow us to establish successful learning outcomes. The students’ parents noted that the ESS programme and the annual SEP were exciting, they enabled the school children to acquire knowledge in specialized areas, helped them in choosing a future career, and aided in participating in specialized subject Olympiads and contests. Moreover, the experience of taking the SEP courses based on CLIL technology was very beneficial to the school students when applying to the university.

Upon completing the SEP courses at Kalashnikov ISTU all the students entered the universities of the Russian Federation. Among them 15 participants are currently studying at Kalashnikov ISTU. Many of these students continue their supplementary education, taking the advanced language programme named “Translator in the field of professional communication” at Kalashnikov ISTU.

Actually, the SEP learning outcomes of school students provide sufficient grounds for us to state that the CLIL technology has the following significant merits:

— in the process of learning, two goals are achieved at a time: learning a foreign language and learning a subject, knowledge of the language becomes a means of studying the subject content;
— motivation to learn a foreign language highly increases due to meaningful content and immersion in the language environment;
— it intensively cultivates higher-order cognitive skills such as analysis, synthesis, generalization, classification, evaluation, etc.;
— the development of lexical speech competence is activated due to the enriched subject and professionally oriented vocabulary;
— meta-subject competence is formed in the course of discussions of abstract terms and concepts due to a minimal context (for example, mathematical or natural science concepts and terms, etc.);
— intensive interaction of all participants of the educational process is observed, which ensures productive mastery of a foreign language;
— cognitively rich corpus of the English language materials is used (video clips, flash animation, web quests, podcasts and other interactive materials from foreign language websites), selected in accordance with the principle of career guidance and having an extremely high motivating potential.

**Conclusion**

In this paper we have looked at experience of implementing supplementary educational programmes for secondary school students using CLIL technology at a technical university. The evidence has been provided that CLIL technology can be an integrating tool to develop a set of competences necessary for Learner-Centred Continuing Education of future specialists in the framework of supplementary educational programmes. The emphasis has been made on “the secondary school — higher school interaction” as a part of continuing multi-level education. The subject, meta-subject and personal characteristics of the attainment targets of the training programmes have been addressed. The article presents the results of the technology approbation attached to the implementation of supplementary educational programmes for secondary school students at Kalashnikov ISTU.

It can be concluded that the Content and Language Integrated Learning Technology, applied in the implementation of SEP for secondary school students, has a universal and powerful adaptive potential to various contexts and changing social demands. CLIL technology allows integrating extensive opportunities of developing a wide set of competences that are vital for the lifelong learning of future specialists.

The findings received in this paper may be of considerable practical value for further research related to developing a system of continuing multi-level education, and may yield many new insights and results.

**References**


