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#### INVESTIGATION INTO THE EFFICACY OF CLIL TECHNOLOGY ON BIOLOGY TEACHERS' PROFESSIONAL COMPETENCE IN KAZAKHSTAN

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This study explores the effectiveness of Content and Language Integrated Learning (CLIL) technology in the context of teaching biology in Kazakhstani public schools, using the example of the Turkestan region. We used a survey as a research tool to examine the effectiveness of this technology in forming the professional competences of biology teachers. The survey was conducted among 32 school teachers in the Turkestan region who had undergone the specialized training in CLIL technology. The survey addresses factors such as teachers' workplace, years of experience

*in teaching biology, the duration of implementing CLIL technology, English proficiency level, challenges faced in the CLIL-based teaching process, its advantages, and its impact on professional development. The findings contribute valuable insights into the practical implications of incorporating CLIL technology in teaching biology. Although the teachers expressed a desire for specialized training and continuing using CLIL technology in their teaching, more research is still needed in this area given Kazakhstan's unique conditions.*

**Key words:** CLIL technology, biology teacher, integrated teaching, 4Cs concept, professional competence.

#### ҚАЗАҚСТАНДАҒЫ БИОЛОГИЯ МҒАЛІМДЕРІНІҢ КӘСІБИ ҚҰЗЫРЕТТІЛІГІНЕ CLIL ТЕХНОЛОГИЯСЫНЫҢ ТИІМДІЛІГІН ЗЕРТТЕУ

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*Бұл зерттеу Қазақстандағы, оның ішінде Түркістан облысының мемлекеттік мектептерінде биологияны оқытуда мазмұн мен тілді интеграцияланған оқыту (CLIL) технологиясының тиімділігін талдауға арналған. Негізгі мақсаты – CLIL технологиясының мұғалімдердің кәсіби құзыреттілігін қалыптастыруға және оқыту сапасын арттыруға ықпалын анықтау. Зерттеу барысында сауалнама әдісі қолданылып, оған CLIL технологиясы бойынша арнайы дайындықтан өткен Түркістан облысының 32 мектеп мұғалімі қатысты. Сауалнама мұғалімдердің жұмыс орны, биологияны оқытудағы тәжірибесі, CLIL технологиясын қолдану ұзақтығы, ағылшын тілін меңгеру деңгейі, әдістемені қолдану барысында туындайтын мәселелер, оның артықшылықтары және кәсіби дамуға әсері сияқты аспектілерді қамтыды. Зерттеу нәтижелері CLIL технологиясын қолдану мұғалімдердің кәсіби өсуіне, оқыту сапасын жақсартуға және оқушылардың пәнне қызығушылығын арттыруға оң ықпал ететінін көрсетті. Сонымен бірге мұғалімдер бұл әдісті әрі қарай дамыту мен қолдануға мүдделі екенін көрсетті. Дегенмен, CLIL технологиясын Қазақстанның білім беру жүйесіне бейімдеу үшін қосымша зерттеулер қажет екені анықталды. Бұл зерттеу CLIL әдістемесінің әлеуетін ашып, оның тиімділігін арттыруға бағытталған жаңа әдістемелік ұсыныстар жасауға мүмкіндік береді. Сонымен қоса, Қазақстандағы биология пәнін оқытуда CLIL технологиясын енгізудің артықшылықтары мен мүмкіндіктерін толыққанды зерделеуге үлес қосады.*

**Түйінді сөздер:** CLIL технологиясы, биология мұғалімі, кіріктірілген оқыту, "4Cs" тұжырымдамасы, кәсіби құзыреттілік.

#### ИССЛЕДОВАНИЕ ЭФФЕКТИВНОСТИ ТЕХНОЛОГИИ CLIL НА ПРОФЕССИОНАЛЬНУЮ КОМПЕТЕНТНОСТЬ УЧИТЕЛЕЙ БИОЛОГИИ В КАЗАХСТАНЕ

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*В данном исследовании рассматривается эффективность технологии интегрированного обучения содержанию и языку (CLIL) в преподавании биологии в государственных школах Казахстана, с акцентом на опыт учителей Туркестанской области. Цель исследования заключается в изучении влияния применения технологии CLIL на формирование профессиональных компетенций педагогов. Для сбора данных использовался анкетный опрос, в котором приняли участие 32 школьных учителя биологии, прошедших подготовку по данной методике. Опрос охватывал различные аспекты: рабочую среду учителей, их опыт преподавания, длительность использования технологии CLIL, уровень владения английским языком, а также ключевые трудности и преимущества, с которыми они сталкиваются. Результаты исследования продемонстрировали, что применение CLIL способствует развитию профессиональных навыков, повышению качества преподавания и уровня мотивации учителей. Вместе с тем, участники указали на существующие проблемы, включая недостаток ресурсов, ограниченное время на подготовку и необходимость в дополнительных тренингах. Несмотря на позитивный опыт внедрения технологии, авторы отмечают, что адаптация CLIL к специфике образовательной системы Казахстана требует дальнейших исследований. Эти данные предоставляют важную информацию для совершенствования методики и расширения её применения в преподавании естественнонаучных дисциплин.*

**Ключевые слова:** технология CLIL, учитель биологии, интегрированное преподавание, концепция "4Cs", профессиональная компетентность.

**Introduction.** Learning a language other than one's mother tongue opens doors to communicating and engaging with individuals from diverse nationalities. Gaining proficiency in a foreign language facilitates a more profound comprehension of the complexities and customs of a different culture. In the fast-paced world of today, being bilingual or multilingual is becoming more and more important as it enables people to advance personally, adjust to changing circumstances, and make valuable contributions to society. This proficiency not only benefits individuals but also fosters mutual understanding among citizens. Therefore, being multilingual is viewed as a route to a bright future in today's culture. Along this journey, Content and Language Integrated Learning proves to be a very useful instrument for putting multilingual educational programs into practice.

CLIL is a method in which non-language disciplines are taught in a foreign language, with a strong and interwoven role for both the language and the subject matter in the learning process. Teaching students a foreign language aims to help them develop into multilingual people who can successfully navigate and reach their full potential in social and professional environments. The purpose is to promote self-governance and self-actualization within a multicultural context.

The integration of multilingual education into the political, economic, and cultural domains today emphasizes how important it is. When a state guarantees its people a modern, high-quality education that meets all current requirements, it can develop and compete with the world's most advanced countries. As a result, language instruction is becoming increasingly important. The emphasis on cultural immersion through the study of language bearers' cultures is at the heart of this challenge.

Although CLIL technology has been introduced into the education system of Kazakhstan in recent years, research on this approach has been conducted globally for several decades. The role of Information and Communication Technologies (ICT) in implementing CLIL, particularly in teaching natural sciences, has gained significance [1, p.13; 2, p.325]. ICT plays a crucial role in creating integrated learning materials, developing lesson plans, and aiding students' comprehension of subject content in a foreign language [1, p.26]. Studies have demonstrated that effective utilization of ICT tools in Content and Language Integrated Learning not only sparks students' interest in the subject but also enhances critical thinking skills, effectively fulfilling the dual objectives of CLIL lessons [2, p.342]. Additionally, research conducted in Spain revealed that students engaged in CLIL-based studies exhibit higher digital competencies compared to those in traditional learning systems [3, p.82]. Beyond ICT, researchers have explored the application of various approaches within the CLIL environment [4, p.1; 5, p.74]. For instance, an experiment at a university in Kazakhstan employed a team-teaching approach involving content and language teachers collaborating to improve students' understanding through precise language guidance [4, p.5]. Similarly, in Spain, employing a problem-based learning approach alongside CLIL yielded positive outcomes in the learning process [5, p.94]. However, educators still encounter challenges in generating authentic materials, which often demands substantial time investment unless ready-made resources are available [6, p.166; 7, p.3].

Existing research indicates that integrated subject and language learning technologies contribute to shaping students' communicative and cognitive competencies [8, p.364; 9, p.231]. However, not much has been studied about the impact of CLIL technology on the professional competence of a biology teacher, what an efficient tool it can become in its formation. This question reveals the relevance of this article.

**The goal** of the research presented in this article is to examine and evaluate the effectiveness of CLIL technology in fostering the development of professional competence in biology teachers. In this context, we have established three **objectives** for the research, as outlined below:

1. To assess the impact of CLIL technology on enhancing the subject-specific knowledge and teaching skills of biology teachers.
2. To evaluate the role of CLIL in improving the ability of biology teachers to integrate language learning with content delivery, thereby fostering a more holistic educational approach.
3. To measure the effectiveness of CLIL in promoting continuous professional development among biology teachers, leading to improved pedagogical practices and student outcomes.

The hypothesis was formulated as follows: If CLIL technology is integrated into the training of biology teachers, then it will substantially enhance their professional competence by improving their ability to effectively merge subject content with language instruction, and as a consequence, this will lead to improved educational outcomes for students.

**Methods and materials.** In our experiment, we carried out a survey of school teachers who have passed a special teacher training course based on CLIL technology to investigate the efficacy of this technology in Kazakhstani conditions. In this study, the following research methods were employed:

1. **Observational Techniques:** Systematic observation was utilized to gather qualitative data on the implementation and impact of CLIL technology in the classroom. This method provided insights into the practical application of CLIL and its effects on teaching and learning processes.
2. **Comprehensive Literature Review:** A thorough review of existing literature was conducted to develop relevant theoretical concepts and frameworks related to CLIL technology. This method helped in understanding the background, current trends, and gaps in the field.
3. **Statistical Analysis:** Statistical methods were applied to analyze survey results, enabling a systematic evaluation of quantitative data. This analysis was crucial for identifying patterns, drawing conclusions, and assessing the effectiveness of CLIL technology based on teacher feedback.

The number of respondents is 32, they are teachers who teach biology in English based on CLIL technology in public schools located in the Turkestan region. Survey questions for school teachers:

- 1) The workplace.
- 2) How long have you been teaching biology?
- 3) How long have you been using CLIL technology in your practice?
- 4) What is your level in English?
- 5) What were the difficulties in using CLIL technology?
- 6) What benefits come with using CLIL technology?
- 7) Has using CLIL technology enhanced your ability as a professional?
- 8) Do you suggest using CLIL technology to help other educators develop their professional skills?
- 9) What recommendations would you give when teaching biology using CLIL technology? (express your thoughts in a sentence or two)

**Results.** The survey was conducted in the form of Google forms and below are the results of the survey:

Table 1 – Duration of experience as a biology teacher

How long have you been teaching biology?	
Years	Percent(%)
1-3	0%
3-5	12,5%
5-10	12,5%
More than 10	75%

Table 2 – Period of application of CLIL technology in practice

How long have you been using CLIL technology in your practice?	
Years	Percent (%)
1-3	21,9%
3-5	78,1%
More than 5	0%

The workplace of the most respondents are state schools located in Turkistan region. As illustrated in Table 1, over 75% of the surveyed school teachers reported having over a decade of experience in teaching biology. Additionally, according to Table 2, these educators have been employing CLIL technology in their pedagogical practices for a period ranging from 3 to 5 years, reflecting a substantial integration of this method into their long-term teaching careers.

Table 3 – Proficiency level of English

What is your level in English?	
Elementary	3,1%
Pre-intermediate	6,3%
Intermediate	37,5%
Upper-intermediate	46,9%
Advanced	6,3%

As detailed in Table 3, the majority of educators are categorized as independent users of the English language, specifically at the B1 (intermediate) and B2 (upper-intermediate) proficiency levels. This proficiency classification signifies that these educators possess the capability to articulate their opinions on a range of topics with a reasonable degree of fluency and accuracy. Furthermore, their language skills enable them to comprehend the principal ideas of complex texts within their specialized fields, demonstrating a solid command of English that supports their professional communication and instructional practices.

Table 4 – Difficulties in using CLIL technology

What were the difficulties in using CLIL technology?	
Lack of vocabulary when using a foreign language in the classroom	56,3%
Takes a lot of time to prepare for the lesson	46,9%
Shortage of CLIL materials	62,5%
Low level of students in a foreign language	40,6%
The emergence of misconceptions	9,4%
Lack of classroom equipment necessary for training	46,9%

The challenges associated with utilizing CLIL technology were primarily attributed to the scarcity of educational materials (Table 4). Specifically, there is a notable deficiency in resources that address the methodologies and potential applications of CLIL for teaching natural science subjects, which significantly hampers the effective implementation of this technology.

Table 5 – Advantages in using CLIL technology.

What benefits come with using CLIL technology?	
Students ' interest increased	75%
My communicative competence has increased	56,3%
Language culture was formed and my worldview expanded	46,9%
The opportunity to get new information on the subject has increased	40,6%
It helped to improve my continuing education	62,5%
It encouraged the use of new teaching technologies in the classroom	43,8%

Table 5 illustrates how the benefits of this technology enhance students' increasing interest in the subject while simultaneously bolstering teachers' commitment to lifelong learning. This table provides detailed evidence on how CLIL technology fosters a heightened enthusiasm for learning among students and encourages educators to pursue ongoing professional development, thereby contributing to a more dynamic and engaged educational environment.

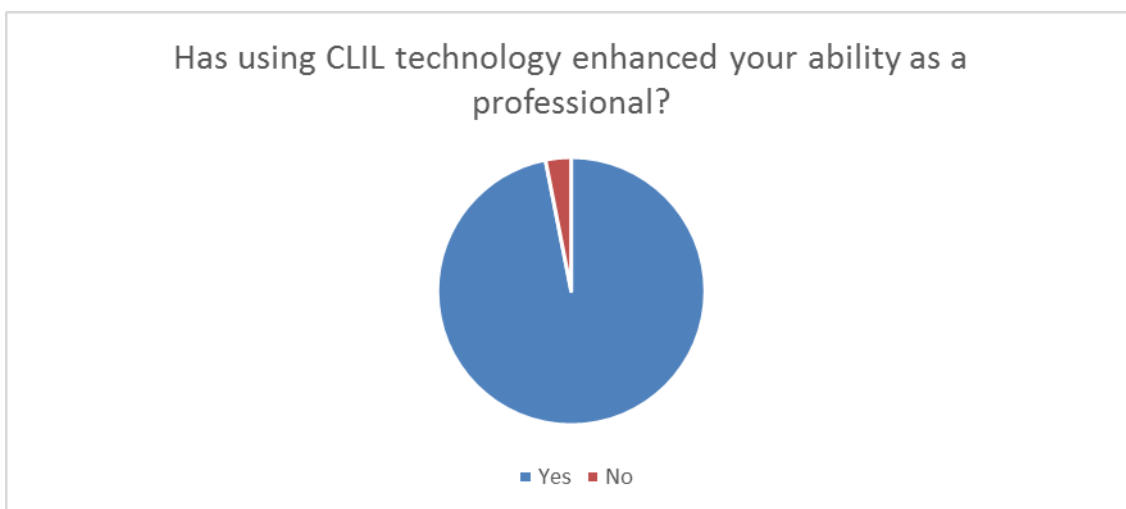


Figure 1 – The impact of CLIL technology on the formation of professional competence of a teacher

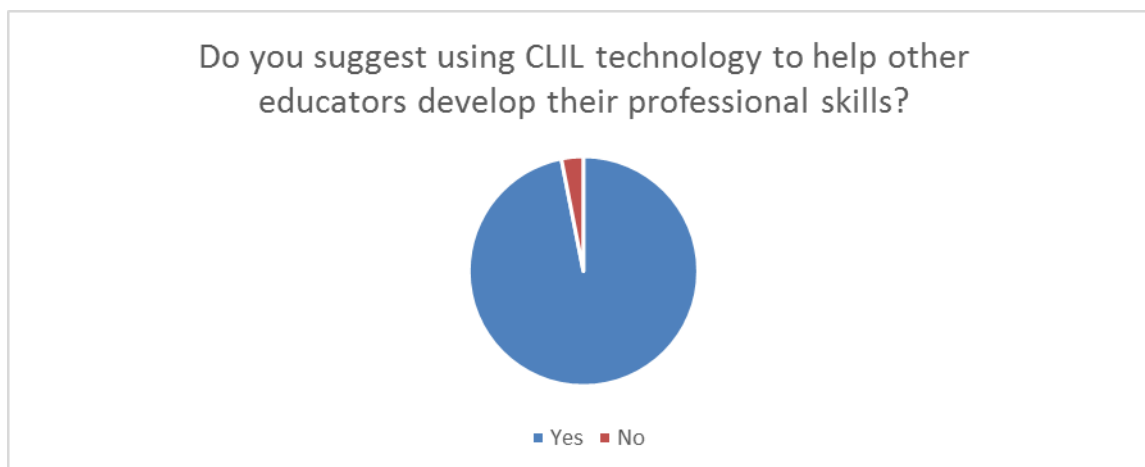


Figure 2 – Teacher's advice in the formation of professional competencies based on CLIL technology

According to the survey, 96% of participants reported that the integration of CLIL technology into their teaching processes positively impacted the development of their professional competencies and endorsed its adoption by other educators. This widespread endorsement underscores the significant value and effectiveness of CLIL technology in the educational context of Kazakhstan.

In addition, in the last open-ended question, the teachers gave the following recommendations:

- “Reproduction of CLIL materials adapted to the educational system of our country”
- “If instructional materials created in an approachable and user-friendly manner are utilized to apply CLIL technology”
- “Organization of language courses for teachers”
- “Organizing more training sessions on CLIL technology”
- “Modernization of CLIL courses in a new format”

- “Organization of conferences, that there will be an exchange of experience”
- “Launching of domestic educational sites for teaching biology in English”

The recommendations provided by teachers underscore a strong desire to enhance the implementation of CLIL technology in education. The suggestions include the adaptation of CLIL materials to fit local educational systems, the creation of user-friendly instructional resources, the organization of language courses and training sessions, the modernization of CLIL courses, and the establishment of platforms for experience sharing and the development of domestic educational sites for teaching biology in English. These insights reflect a comprehensive approach to improving CLIL's integration, highlighting the need for tailored resources, professional development, and collaborative opportunities to maximize the technology's effectiveness and support educators in delivering high-quality, bilingual education.

**Discussion.** According to the results of the surveys, it is proved that CLIL technology is an effective tool for the formation of professional competencies of secondary school teachers in teaching biology. Nevertheless, the main obstacles are the lack of experts using CLIL technology, the dearth of didactic and methodological resources tailored for using this technology in the classroom, and the low proficiency of foreign language teachers [10, p.40; 11, p.151]. In addition, the next domestic study noted that teachers have a low level of communication competence in a foreign language, despite the fact that natural science subjects have been taught in English in universities and general education schools of the country over the past few years [12, p.179]. As for research abroad, it was concluded that the ability of teachers to carry out instruction is particularly impacted by their level of language competency when teaching subjects in English [13, p. 131]. Moreover, the results of a study conducted in Latin American countries for 10 years (2008-2018) revealed that the approach to achieve academic success in teaching with CLIL technology is to offer pre – training programs for teachers [14, p.295]. Because of this, the ideal way to address these issues is to prepare a specialist who can teach biology inside the walls of a higher education institution using specialized CLIL technology and who possesses a high degree of proficiency in a foreign language.

As evidenced by the results of the teacher survey, there was a marked increase in students' interest in the subject during biology lessons conducted using this technology, a trend that is further substantiated by a parallel phenomenon observed in domestic and external studies [15, p. 24; 16, p. 103]. This consistency across different studies underscores the efficacy of the technology in enhancing student engagement. Nevertheless, to ensure a profound and sustained impact on students' integrated content and language learning, it is imperative to adopt a meticulously structured and explicit teaching approach that effectively aligns instructional strategies with the dual objectives of content mastery and language acquisition [17, p.65].

Today, learning foreign languages is essential because it allows teachers to freely navigate in the educational space, delve into the secrets of the world of knowledge and show their abilities. In this context, active integration of a foreign language with professionally significant disciplines serves as the foundation for how technology of integrated learning based on content and language enhances the process of developing foreign language competencies. Since it is covered in the curriculum, students who are familiar with the fundamentals of the topic can pick up the language in a foreign language with ease. This lessens the challenge of conveying ideas and expert viewpoints in a foreign language. Additionally, because their primary concentration is on the topic matter, students' attention is diverted from the issues related to their fear of making grammatical errors.

By integrating CLIL technology into the classroom, teachers can holistically enhance their professional competence while simultaneously advancing the qualifications, national perspectives, and cognitive abilities of their students. This is achieved through the well-established “4C” framework, which allows for the development of linguistic and communicative competencies essential for personal, intercultural, and professional growth. Notably, CLIL accomplishes this without the need for additional curriculum time, effectively supporting the comprehensive development of both students and educators through its core principles. This is a characteristic point that distinguishes CLIL technology from other teaching methods [18, p. 6]. Coyle introduced “4C” in implementing CLIL lessons in 1999, “4C” stands for Content (includes basic knowledge of the subject, skills and abilities of the students to obtain new materials), Communication (forms a favorable condition where students can communicate and interact with each other in a language which is being used to teach the subject), Cognition (includes HOTS and LOTS), Culture (regard for one's own and other countries' cultures). While designing the lesson plan of hard CLIL (main focus on the subject), it is compulsory to create exercises on the basis of HOTS (high order thinking skills), which in turn can develop critical and analytical skills of the educator. This influences the teacher's analysis of language and ongoing acquisition of new skills.

In a CLIL-based biology classroom, the 4C concept (Content, Communication, Cognition, and Culture) is strategically employed to create a rich and multidimensional learning environment that enhances both subject matter expertise and language proficiency. This approach begins with the integration of “Content”, where students delve into topics such as ecosystems, learning key scientific terms and concepts in both their native language and the target language, such as English. This dual-language approach not only solidifies their grasp of biological principles but also expands their vocabulary and comprehension in another language, effectively blending content mastery with linguistic development.

Moving to “Communication”, the CLIL framework encourages students to actively engage in discussions, debates, and presentations on complex topics like human anatomy, using precise biological terminology in the target language. This not only refines their ability to articulate scientific ideas but also builds confidence in their bilingual communication skills, preparing them for academic and professional contexts where multilingualism is an asset.

“Cognition” is addressed through activities that require higher-order thinking, such as analyzing genetic inheritance patterns using tools like Punnett squares. These tasks challenge students to apply critical thinking and problem-solving skills in both their native and target languages, promoting cognitive flexibility and deeper understanding. The use of the target language in these cognitive tasks reinforces their ability to think critically and reason scientifically in more than one language, thus enriching their overall cognitive development.

Finally, the “Culture” component of the 4C framework is woven into lessons on topics like biodiversity, where students explore and compare how different cultures perceive and interact with their local environments and wildlife. This not only broadens their understanding of global ecological issues but also fosters a sense of intercultural competence, as they learn to appreciate and articulate diverse perspectives in the target language.

Through this comprehensive application of the 4C concept, CLIL technology ensures that students receive a well-rounded education that goes beyond the acquisition of content knowledge. It nurtures their language abilities, enhances their cognitive skills, and deepens their cultural awareness, all within the framework of a single, integrated learning experience. Consequently, both students and teachers benefit from this approach, with teachers developing their professional competencies in a holistic manner and students gaining the linguistic, cognitive, and cultural tools necessary for their personal and academic growth.

Teachers should adopt a range of strategies to deliver educational materials, such as incorporating multimedia resources (videos, interactive simulations, and digital tools), utilizing differentiated instruction to cater to diverse learning styles, and employing project-based learning to facilitate hands-on, real-world applications. Additionally, strategies like cooperative learning groups, formative assessments to track progress, and scaffolded support for complex concepts can enhance the learning experience. By integrating these varied approaches, teachers can more effectively present content, engage students, and address individual needs within the updated curriculum. One of the most crucial things to consider when implementing a learning process based on CLIL technology is the teacher's ability to accurately evaluate. Because the teacher may face the confusion of how to assess the content and the language [19, p.2].

When children embark on the journey of learning a new subject, it is imperative that they approach the process with a fervent enthusiasm. This intense passion acts as the driving force behind their ability to achieve meaningful and sustained success, as motivation is the catalyst that propels them to embrace and master new concepts. In this context, Content and Language Integrated Learning emerges as an invaluable pedagogical approach, serving as a powerful instrument for significantly enhancing students' intrinsic motivation to engage with their studies. When students are deeply motivated and invested in their learning experiences, it creates a positive feedback loop; this renewed vigor not only enriches their educational outcomes but also has a profound impact on their teachers. Educators, inspired by their students' enthusiasm and progress, often find themselves reinvigorated, leading to a heightened commitment to their own professional growth. This, in turn, drives them to pursue further education and continually refine their teaching practices, creating a dynamic and ever-evolving learning environment that benefits all participants involved.

**Conclusion.** Notwithstanding the challenges the study found, CLIL technology demonstrates its effectiveness in the formation and enhancement of professional competencies of biology teachers. According to the results of the study, many advantages of taking biology classes based on CLIL technology were identified. The hypothesis was justified by demonstrating that the integration of CLIL technology into biology teacher training significantly enhanced their professional competence. This improvement was achieved through the effective combination of subject content and language instruction, which in turn led to better educational outcomes for students, as evidenced by the data collected and analyzed in the study.

The instructors saw that as their students' enthusiasm in the subject grew, so did their worldviews, and this encouraged them to pursue continuing education. It is often acknowledged that putting CLIL into practice is a difficult task that calls for more time, energy, expertise, and understanding. However, a lot of educators are still inspired to use this strategy. For this reason, it is essential to begin teacher preparation at the university level.

It is critical that educators are able to demonstrate a thorough comprehension of the CLIL 4 Cs framework, which includes elements like content, cognition, communication, and culture. It is imperative that they exhibit their capacity to discern the objectives and tenets of incorporating each of those components within their instructional ideas. Teachers should be able to strike a balance between content and language development of learners as well as encouraging their higher order thinking.

The instructors' comments indicate that they would like to get special education and continue their training with CLIL technology; however, given Kazakhstan's circumstances, more research in this area is still required.

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