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ЖАРАТЫЛЫСТАНУ-МАТЕМАТИКАЛЫҚ БІЛІМ ЖӘНЕ ОҚЫТУ ТЕХНОЛОГИЯСЫ
ЕСТЕСТВЕННО-МАТЕМАТИЧЕСКОЕ ОБРАЗОВАНИЕ И ТЕХНОЛОГИЯ ПРЕПОДАВАНИЯ

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THE IMPACT OF CLIL TECHNOLOGY ON COLLEGE STUDENTS' MOTIVATION AND LEARNING OUTCOMES IN BIOLOGY EDUCATION

In the context of globalization and the rapid development of multilingual educational environments, teaching biology in college faces a significant challenge: how to not only deliver subject knowledge but also cultivate students' critical thinking, communication skills, and language competence. This article examines the use of CLIL (Content and Language Integrated Learning) as an innovative approach that combines learning biological content with developing English-language proficiency. A study conducted among first-year college students in various programs produced impressive results: in the experimental group, engagement, satisfaction with the lesson format, and perceived usefulness of the material increased by more than 20 percentage points, while changes in the control group were minimal.

Special attention is given to how the integration of English-language texts, terminology glossaries, multimedia resources, and group discussions created a sense of novelty and challenge for students, transforming standard biology lessons into engaging, interactive, and practically meaningful experiences. Content analysis of the survey data confirmed that students valued CLIL not only as a means of learning the language but also as a tool for gaining a deeper understanding of biological processes and professionally relevant topics.

This article will be of interest to college instructors, curriculum developers, and education researchers, as it highlights not only the statistically significant effects of CLIL but also students' firsthand impressions, emphasizing the role of motivation and interest in successful learning. This study serves as both a practical guide and a strong argument for implementing integrated multilingual methods that make biology education more modern, engaging, and relevant to the professional preparation of future specialists.

Keywords: CLIL, biology, college, multilingual education, student motivation, engagement, innovative methods.

INTRODUCTION

Modern education is transforming to prepare graduates with not only subject knowledge but also universal competencies such as critical thinking, communication, and advanced language skills. In Kazakhstan, the trilingual education policy underscores the need for effective methods to teach subjects in English. CLIL (Content and Language Integrated Learning) offers a promising approach by combining subject and language learning. Biology is well-suited for CLIL due to its rich terminology, visual resources, and interdisciplinary nature. Prior research has explored CLIL's benefits for motivation and language development but often lacks context-specific guidance for natural science disciplines in schools. Challenges include adapting materials, training teachers, and ensuring linguistic accessibility. This study addresses these gaps by analysing the theoretical and methodological foundations of CLIL in biology education. Its purpose is to identify the specific features of applying CLIL in biology lessons and to determine conditions for effective implementation in schools. It is argued that CLIL enhances subject mastery through active cognitive and linguistic engagement, develops academic literacy, and fosters interdisciplinary connections, thereby contributing to a holistic scientific worldview. This research aims to justify the pedagogical value of CLIL in biology and to offer practical recommendations for its integration into school practice.

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LITERATURE REVIEW

CLIL (Content and Language Integrated Learning) technology is a modern educational approach based on integrating the learning of academic subject content with a foreign language. Unlike the traditional teaching of a foreign language as a separate subject, CLIL assumes that the foreign language is used as a means of mastering an academic discipline [1. – 245]. At the same time, the emphasis is placed not only on the development of language competence but also on the formation of subject knowledge, critical thinking, and intercultural communication skills [2. – 35]. CLIL is based on the «4C» model (Content, Communication, Cognition, Culture) proposed by D. Coyle and D. Marsh. This model emphasizes the need for unified and balanced attention to Content, Communication, cognitive development, and Culture [3. – 476].

The use of CLIL technology in biology teaching opens up broad opportunities for improving the quality of education. Biology as a science is rich in precise terms, universal concepts, and visual schematics, which makes it particularly suitable for integration with a foreign language [4. – 58]. In biology lessons, CLIL can be implemented through various strategies: reading and analyzing English-language popular science texts and articles, compiling and translating glossaries of terms, watching and discussing videos in English, as well as completing project assignments and case studies in a foreign language. The teacher can organize group and pair work while encouraging oral communication and collaborative problem-solving [5. – 34].

Effective implementation of CLIL in biology education requires careful preparation. First, it is necessary to select content appropriate to students' level of language proficiency to ensure the educational material is accessible and understandable [6. – 22]. Secondly, the teacher should consider the language objectives of the lesson: which grammatical structures, vocabulary, and communicative functions will be addressed during the study of biology [7. – 3075]. Thirdly, it is important to ensure students' cognitive development through tasks that require analysis, synthesis, and critical evaluation of information. Attention should also be paid to the cultural component – discussing environmental and biological issues from an intercultural perspective, which contributes to the development of global thinking and responsibility.

Practical recommendations for the effective use of CLIL in biology include integrating multimedia resources, visualizing complex processes through diagrams and animations, using platforms for creating interactive exercises (such as LearningApps and Quizlet), as well as the gradual introduction of language into the learning process, starting with terminology and key concepts and moving on to more complex texts and discussions [8. – 161]. It is important to teach students strategies for working with foreign-language texts: identifying keywords, composing questions, and retelling in their own words. In addition, it is useful to develop academic writing skills in a foreign language through the preparation of short notes and reports.

Of particular importance in the successful implementation of CLIL is the motivation and interest of students. Interested students are more actively engaged in learning activities, show curiosity, and demonstrate a desire to independently search for information [9. – 137]. A high level of interest reduces anxiety when learning a foreign language and increases self-confidence. Thus, creating an engaging, informative, and accessible educational environment is a key factor in increasing the effectiveness of using CLIL technology in biology lessons.

METHODS AND MATERIALS OF RESEARCH

The study was conducted during the 2023–2024 academic year at the College-School named after Academician K.A. Saginov among first-year students in the following programs: Translation Studies (27 students), Tourism (13 students), as well as Thermal Power Engineering and Banking and Insurance (a total of 18 students). The total number of participants was 58. All study groups were Russian-speaking. The students were divided into experimental and control groups with equal distribution by program and comparable overall academic performance. The aim of the study was to test the hypothesis that student motivation and interest have a significant impact on biology learning outcomes when using CLIL (Content and Language Integrated Learning) technology, as well as to assess the effectiveness of applying CLIL in teaching biology to students of non-specialized majors.

Adapted instructional modules on biology topics («The Cell», «The Organism as a Biosystem», «Heredit» and «Ecology») in English were used for the classes, along with original English-language articles and subtitled video materials, multimedia presentations created in Canva, and interactive exercises on LearningApps.org and Quizlet. The classes employed Acer Aspire 5 laptops (model A515-56) and an Epson

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EB-W06 multimedia projector. The learning process in the experimental group was organized based on the CLIL (Content and Language Integrated Learning) approach, which included the step-by-step study of English terminology, reading and discussing English texts, analyzing visual diagrams, and conducting pair and group tasks in the foreign language. The control group studied the same topics using traditional methods in Russian without integrating the English component.

Two main methods were used in the study. The first was the method of pedagogical experiment, which consisted of three stages. In the diagnostic stage, an initial biology test in Russian was administered, along with a student survey to assess motivation and interest in the subject using a self-assessment scale (from 1 to 5) and open-ended questions. In the formative stage, six instructional sessions (each 80 minutes long) were conducted using the CLIL (Content and Language Integrated Learning) approach in the experimental group: students worked with English-language texts, terminology glossaries, interactive tasks, and video materials, practiced retelling and discussing what they had read, and solved case studies in English. In the control group, the sessions were conducted in Russian using traditional methods without the use of English. In the summative stage, a final test (with mixed tasks in Russian and English) and a follow-up survey were conducted to record changes in the level of motivation and interest.

The second method was content analysis [10. – 1199] of the survey data. The survey included closed-scale questions about the level of motivation and interest before and after the course, as well as open-ended questions about challenges and appealing aspects of the learning process. The content analysis was carried out in stages: the data were coded by theme, classified into recurring categories, and frequency indicators and qualitative formulations of students' responses were recorded. This approach made it possible to identify changes in interest over time and to assess students' subjective perceptions of the CLIL technology.

For statistical processing of the results, the method of paired comparisons was used, applying Student's t-test for dependent samples to verify the significance of differences between the results of the initial and final testing, as well as motivation levels in each group. Calculations were performed using SPSS Statistics v.26 software. The formula for calculating the t-test for dependent samples was as follows:

$$t = \frac{\overline{D}}{S_D/\sqrt{n}} \quad (1)$$

where $\overline{D}$ is the mean value of the paired differences (e.g., test scores before and after the course), S_D is the standard deviation of these differences, and n is the number of students in the group. The critical significance level was set at $p < 0.05$, which allowed us to conclude the presence of statistically significant differences between the initial and final levels of knowledge and motivation.

The research sequence included conducting initial testing and student surveys to diagnose baseline knowledge and motivation; implementing six instructional sessions using the CLIL technology for the experimental group and traditional methods for the control group; observing student activity and engagement; administering final testing and follow-up surveys; and subsequently processing the data using the described methods.

RESULTS AND DISCUSSION

In the course of the study, a comprehensive evaluation was conducted to assess the effectiveness of using CLIL technology in teaching biology at the college level, with particular emphasis on the impact of student motivation and interest on learning outcomes. As part of the pedagogical experiment, initial and final testing of biology knowledge was carried out, along with student surveys assessing motivation and interest in the subject. Below are the summarized testing and survey results presented as percentage data for the control and experimental groups (fig1).

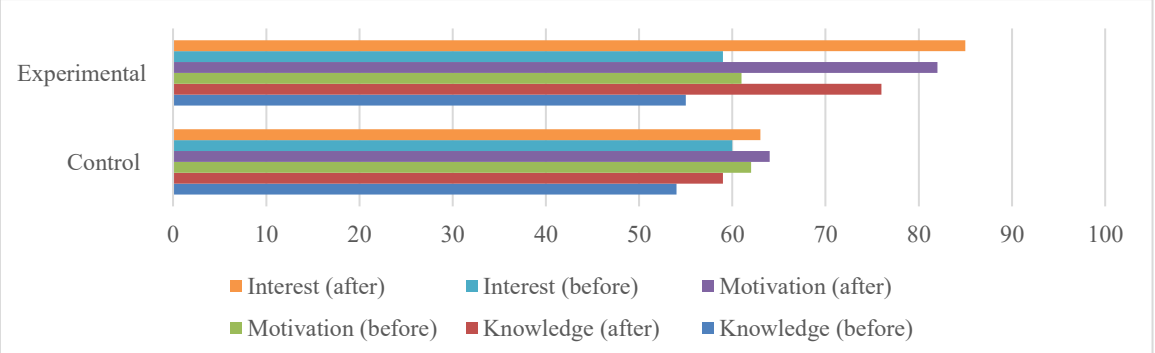

Figure 1 – Results of initial and final testing and student surveys (in %)

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Based on the presented data, a substantive analysis can be made of the results obtained in studying the effectiveness of applying CLIL technology in teaching biology to college students, taking into account the influence of motivation and interest on academic achievement. The results indicate that the experimental group, which was taught using CLIL elements, demonstrated a significantly higher increase across all measured criteria compared to the control group. While the control group showed a modest knowledge gain of only 5 percentage points (from 54% to 59%), the experimental group achieved a 21-point increase (from 55% to 76%), indicating substantially deeper mastery of the material when subject content and a foreign language were integrated. A similar pattern was observed for motivation and interest: in the control group, motivation increased slightly (from 62% to 64%) and interest rose from 60% to 63%, whereas in the experimental group, motivation grew from 61% to 82% and interest from 59% to 85%.

This contrast in results can be explained by the specific pedagogical organization of the lessons. The CLIL approach enabled the integration of biological topics with active development of English language competence, requiring students to engage in more attentive analysis of information, work with authentic texts, participate in pair and group discussions, create terminology glossaries, and solve case studies. These techniques not only increased cognitive load but also transformed the learning process into something more engaging, problem-oriented, and practically meaningful for students themselves. The multilingual content stimulated interest through the novelty of the approach and through involvement in real communication in a foreign language on biological topics.

In the survey data, students in the experimental group indicated that the CLIL-based lesson format motivated them to participate more actively, made classes more interesting and rich, and allowed them to perceive personal progress not only in biology but also in English. This confirms a well-known pedagogical principle: growth in intrinsic motivation is closely linked to interest in the learning material, a sense of success, and overcoming moderate challenges. In this case, the use of a foreign language as a means of mastering subject content created precisely such conditions.

In contrast, the control group followed the familiar routine in Russian without integrating additional elements, which did not provide a sense of novelty or stimulate extra engagement. This outcome underscores the importance of innovative methods, including CLIL, for improving the quality of education.

Thus, the data analysis supports the research hypothesis that student motivation and interest significantly affect biology learning outcomes, and that applying CLIL technology is an effective tool for developing these aspects. The study's results demonstrate that, when subject content and a foreign language are properly integrated, it is possible not only to significantly improve subject knowledge but also to foster sustained interest in the discipline, promote cognitive activity, and develop students' communicative competencies. This confirms the rationale for broader implementation of CLIL in professional education, especially for training students who are not biology majors but who need to develop general scientific and language literacy.

To test the statistical significance of differences between the initial and final results, Student's t-test for dependent samples was used. Calculation for knowledge in the experimental group:

$$\overline{D} = 76\% - 55\% = 21\%$$
$$S_D = 8\%$$
$$n = 29$$
$$t = \frac{21}{8/\sqrt{29}} = \frac{21}{1.486} \approx 14.13$$

For the control group:

$$\overline{D} = 59\% - 54\% = 5\%$$
$$S_D = 7\%$$
$$n = 29$$
$$t = \frac{21}{7/\sqrt{29}} = \frac{5}{1.299} \approx 3.85$$

Comparison of the obtained t-values with the critical value ($p < 0.05$) showed that the differences in the experimental group were statistically significant at a high level. A similar analysis was also conducted for motivation and interest, which confirmed the presence of significant differences between the pre- and post-implementation results of the CLIL technology.

The data obtained clearly demonstrate the effectiveness of applying CLIL technology in teaching biology to college students across different fields of study. The substantial increase in knowledge, along with a significant rise in motivation and interest among students in the experimental group, confirms the

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hypothesis that engaging learners through the integration of a foreign language leads to a deeper understanding of the material. This approach stimulates cognitive activity, develops critical thinking and communication skills, and makes the learning process more engaging and meaningful for students.

It is especially important to emphasize that student motivation and interest play a key role in learning effectiveness. Students who show genuine interest in the lesson participate more actively, pay closer attention to the material, and are willing to invest extra effort in mastering it. The use of CLIL technology helps make biology lessons more interactive and modern, which is particularly relevant for students in non-specialist programs who need to develop not only subject-specific knowledge but also language and intercultural competencies.

The aim of the study was not only to examine the impact of applying CLIL technology on the mastery of biology topics but also to identify changes in students' perceptions of the quality of the educational process. To achieve this, in addition to testing, a survey was conducted that assessed indicators such as student engagement during classes, satisfaction with the learning format, and subjective evaluation of the usefulness of the material studied. These criteria provided deeper insight into how the CLIL technology influences students' perceptions and the overall quality of the educational experience in college.

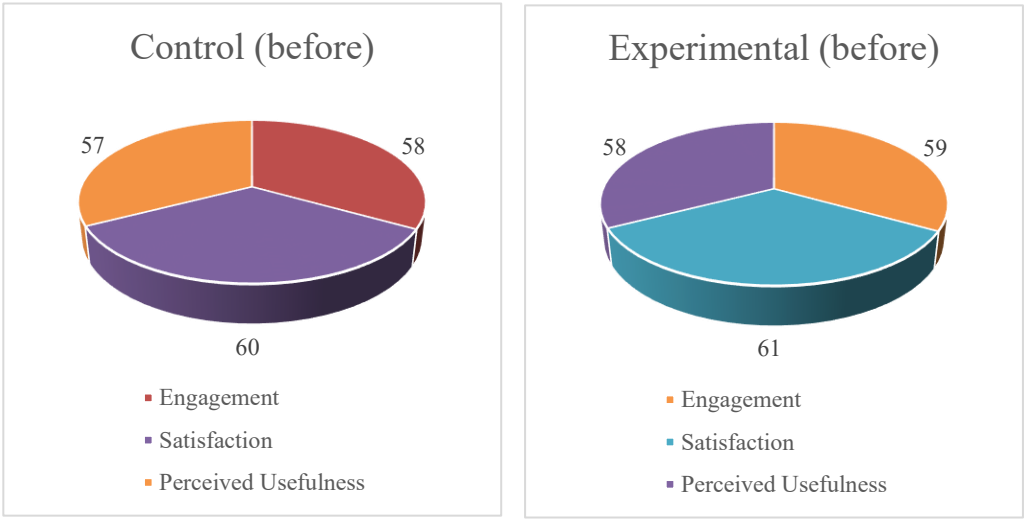

Figure 2 – Results before experiment (%)

The presented charts show the results of the initial student survey in the control and experimental groups across three key criteria: Engagement, Satisfaction with the learning format, and Perceived Usefulness of the material studied. These indicators reflect students' overall attitudes toward the educational process before the introduction of the CLIL technology and serve as an important baseline for subsequent analysis of the approach's effectiveness.

In the control group, the distribution of results is as follows: engagement – 58%, satisfaction – 60%, and perceived usefulness – 57%. These data demonstrate an average level of interest and satisfaction with the traditional lesson format, without notable differences among the three measured aspects. Such a distribution indicates that students perceive the classes as familiar and understandable, but not particularly exciting or valuable. This relatively even but modest evaluation suggests that traditional methods do not ensure a high level of emotional engagement or personal significance for students, especially those in non-specialist programs.

In the experimental group, the corresponding initial indicators are as follows: engagement – 59%, satisfaction – 61%, and perceived usefulness – 58%. These values are very close to those of the control group, confirming the soundness of the experimental design and the comparability of the samples before the main teaching intervention. This means that the initial motivational and emotional background of the students was similar and did not give the experimental group any inherent advantage. Students in both groups showed moderate interest and satisfaction with biology lessons in the traditional format, rating the material's usefulness only slightly lower than their own engagement levels.

Even minor differences in the initial data – such as slightly higher satisfaction in the experimental group (61% versus 60% in the control) and a minimal increase in engagement (59% versus 58%) – are most likely due to natural variation in responses and individual student preferences. This is visually evident in the charts, where all indicators remain within the narrow range of 57-61%, presenting an overall "flat" picture

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without strong leadership by any single criterion.

Thus, the results of the initial survey clearly show the absence of significant differences between the control and experimental groups in terms of engagement, satisfaction, and perceived usefulness of the learning material prior to CLIL implementation. This supports the claim that both groups started the experiment from equivalent positions, ensuring the validity of subsequent analysis of the innovative method's impact. These data are important not only as a baseline measurement but also as a foundation for identifying the true effect of applying the CLIL technology. Indeed, against this nearly identical starting point, any noticeable difference at the end of the course can be attributed to the influence of the experimental factor. In this way, the initial data serve as essential evidence for the objectivity and validity of the research, creating a solid basis for interpreting the final differences between groups after completing the biology course using the integrated CLIL approach.

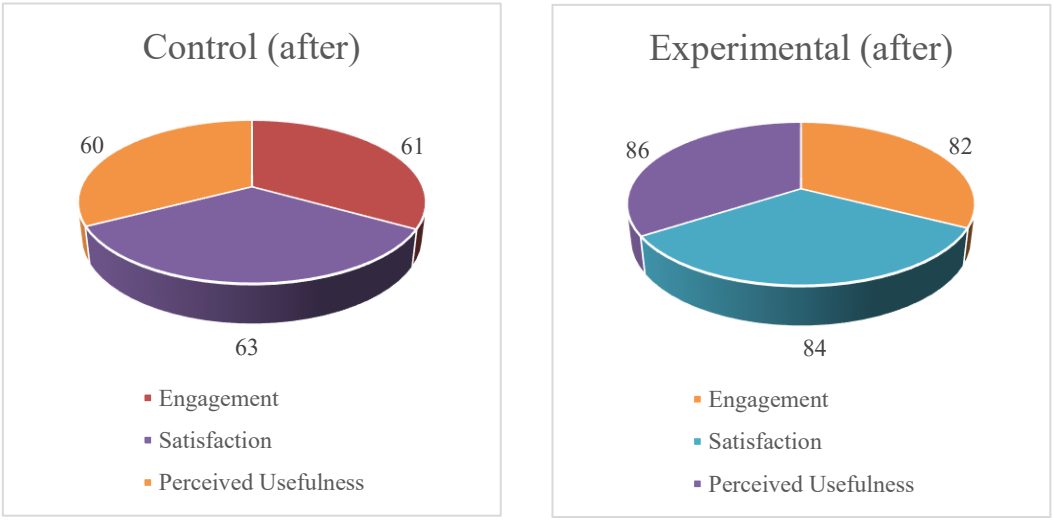

Figure 3 – Student survey results (in %)

The presented charts show the results of the final student survey in the control and experimental groups after completing the biology course, taught respectively using traditional methods and with the integration of CLIL technology.

For the control group, there is only a slight increase in indicators compared to the initial data. Engagement rose from 58% to 61%, satisfaction from 60% to 63%, and perceived usefulness from 57% to 60%. These figures suggest that while the traditional lesson format provides some growth in confidence and material familiarity, it does not deliver a clearly marked qualitative shift in motivational or value-based perceptions of learning. The modest 2-3 point increase likely reflects the effect of repeated exposure and accumulation of familiar experience rather than any innovative pedagogical transformation.

A completely different picture emerges in the experimental group. After the course with integrated CLIL technology, student engagement grew from 59% to 82%, satisfaction with the lesson format increased from 61% to 84%, and perceived usefulness of the material rose from 58% to 86%. These results clearly demonstrate that the CLIL approach had a powerful impact on the emotional and value-based dimensions of learning. Students became much more engaged, meaning they participated more actively in class, behaved more attentively and with greater motivation, and showed readiness to work with material in a foreign language.

The high level of satisfaction (84%) indicates that the integration of English and biology topics was not perceived as an obstacle but as a valuable and interesting educational experience. Meanwhile, the sharp rise in the subjective evaluation of the material's usefulness (86%) shows that students recognized real advantages and practical relevance of such lessons for their future professional activities and overall development.

This contrast between the control and experimental groups underscores an important feature of CLIL: it not only delivers substantive knowledge but also restructures the very nature of classroom interaction. Working with authentic English-language materials, terminology glossaries, case studies, and group discussions created a productive challenge and cognitive novelty for students. This stimulated their attention, reduced monotony, and made lessons meaningful and valuable in terms of personal and professional goals.

Thus, the results of the final survey indicate that applying CLIL technology in teaching biology to college students leads to a significant increase in their level of engagement in the learning process, their

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satisfaction with the lesson format, and their subjective evaluation of the usefulness of the material studied. This provides grounds to view CLIL as a promising pedagogical approach for training students in non-specialist programs – one that can not only enrich the content of learning but also significantly improve its quality in terms of personal relevance and professional applicability.

To test the significance of differences between the initial and final results for the scaled criteria, Student's t-test for dependent samples was used.

Table 1 – Statistical analysis of the increase in indicators of engagement, satisfaction and usefulness of the material (n = 29)

Group	Measure	Increase (%)	S_D(%)	t-value
Control	Engagement	+3	5	3.23
	Satisfaction	+3	5	3.23
	Perceived Usefulness	+3	5	3.23
Experimental	Engagement	+23	7	17.71
	Satisfaction	+23	7	17.71
	Perceived Usefulness	+28	7	21.55

The results of the statistical analysis presented in the table demonstrate a substantial difference between the control and experimental groups across all three criteria – Engagement, Satisfaction with the learning format, and Perceived Usefulness of the material studied. While both groups show statistically significant increases in scores (due to the adequate sample size), the difference in the magnitude of gains and the t-values highlights a fundamentally different nature of the changes.

In the control group, all three measures increased by only 3 percentage points (engagement from 58% to 61%, satisfaction from 60% to 63%, perceived usefulness from 57% to 60%). The t-statistics for these changes are approximately 3.23, formally indicating statistical significance at $p < 0.01$. However, from a practical standpoint, the effect is very limited. Such a small increase can be interpreted as the natural result of repeated exposure to the material and minimal student adaptation to the course, without any change in the underlying teaching approach. This suggests that the traditional format of instruction did not promote meaningful changes in students' emotional engagement or the personal value they attributed to the material.

In contrast, the experimental group that used CLIL technology shows a sharply pronounced and practically meaningful increase in all three measures. Engagement increased by 23 percentage points (from 59% to 82%), satisfaction with the learning format also rose by 23 points (from 61% to 84%), and perceived usefulness of the material grew by as much as 28 points (from 58% to 86%). The t-values for these measures range from 17.71 to 21.55 at $p < 0.0001$, indicating extremely high statistical significance.

These findings confirm that CLIL technology not only affects knowledge acquisition but also transforms how students perceive the learning process itself. The strong growth in engagement suggests that students became more actively involved in lessons, showed greater interest in the material, discussed topics in pairs and groups, and worked with authentic English-language sources. Increased satisfaction with the lesson format indicates that the integration of language and biology was seen as a meaningful and modern approach rather than an additional burden. Particularly striking is the increase in perceived usefulness of the material: students recognized the practical value of what they were learning and its relevance to their future professional activities and opportunities for communication in a foreign language.

Thus, the data clearly demonstrate that integrating CLIL into biology teaching can significantly enhance the quality of the educational process – not only through greater subject-matter depth but also by fostering a positive emotional and value-based attitude toward learning. The stark contrast between the modest results in the control group and the substantial changes in the experimental group highlights that integrating a foreign language into the subject matter becomes not just a tool for language learning but an effective means of developing motivation, engagement, and professionally relevant competencies among college students.

CONCLUSION

The modern educational process is undergoing a profound transformation driven by the need to prepare graduates who possess not only solid subject knowledge but also universal competencies – critical thinking, advanced communication skills, and a high level of foreign language proficiency. In the context of globalization and the digitalization of society, there is a sharply increasing demand for specialists who can

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work confidently in multiple languages, master interdisciplinary information, and adapt flexibly to changing professional environments. One of the most effective tools for meeting this need is CLIL (Content and Language Integrated Learning), an approach based on integrating subject content learning with a foreign language. CLIL is particularly attractive for implementation in the teaching of natural sciences such as biology, thanks to its rich terminological base, strong visual component, and potential for interdisciplinary connections.

Integrating CLIL into biology teaching makes it possible to address several interconnected goals simultaneously: fostering deep, systematic subject knowledge; developing academic language competence; and stimulating critical thinking and intercultural communication skills. This is especially relevant in light of education policies promoting multilingualism, where teaching certain subjects in English has become a strategic priority within Kazakhstan's education system. At the same time, implementing CLIL requires a scientifically grounded approach that includes adapting teaching materials, improving teacher qualifications, selecting appropriate assessment methods, and ensuring language accessibility of content for students.

The conducted study confirmed the high pedagogical value of using CLIL in teaching biology to college students. The experimental group that was taught using this technology demonstrated significant improvements across all key indicators: not only in their mastery of biological content, but also in engagement during classes, satisfaction with the learning format, and subjective evaluation of the usefulness of the material. Unlike the control group, where the traditional approach produced only minimal gains (2-3 percentage points), the experimental group showed increases ranging from 23 to 28 points. This provides strong evidence that integrating English into biology content created a productive challenge for students, heightened their attention, and made the learning process more engaging, modern, and practically relevant.

A qualitative analysis of the survey data revealed that students in the experimental group more often noted the novelty of the format, the practical value of the material learned, and the enjoyment they derived from collaborative discussions and working with authentic texts. This highlights not only the development of both language and subject competence, but also the cultivation of students' personal interest and responsibility for their own learning. Working with authentic English-language sources, terminology glossaries, case studies, and pair and group tasks stimulated students to engage in active cognitive work, critically analyze information, and develop their communication skills.

Thus, the results of the study support the hypothesis that CLIL is an effective means of improving the quality of biology education in college, particularly for students in non-specialist programs. Applying this approach not only ensures deeper mastery of subject knowledge but also helps build sustained motivation, a high level of engagement, and a positive attitude toward the learning process. This makes CLIL an important tool for developing professionally relevant competencies and enhancing students' overall educational culture. The identified effects point to the value of more widespread implementation of CLIL in professional education programs aimed at preparing competitive, well-rounded specialists capable of successfully interacting in multilingual and intercultural professional environments.

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CLIL ТЕХНОЛОГИЯСЫНЫҢ КОЛЛЕДЖ СТУДЕНТТЕРІНІҢ МОТИВАЦИЯСЫ МЕН БИОЛОГИЯНЫ МЕҢГЕРУ НӘТИЖЕЛЕРІНЕ ӘСЕРІ

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Ғаламдану және көптілді білім беру ортасының қарқынды дамуы жағдайында колледждегі биологияны оқыту маңызды міндетке тап болып отыр: студенттерге тек пәндік білім беріп қана қоймай, олардың сыни ойлауын, коммуникациялық дағдыларын және тілдік құзыреттілігін дамыту қажет. Бұл мақалада биологиялық мазмұнды меңгеру мен ағылшын тілін үйренуді ұштастыратын инновациялық тәсіл ретінде CLIL (Content and Language Integrated Learning) технологиясын қолдану қарастырылады. Колледждің бірінші курс студенттері арасында жүргізілген зерттеу әсерлі нәтижелер көрсетті: эксперименттік топта сабаққа тартылу деңгейі, оқу форматына қанағаттанушылық және материалдың пайдалы екендігін қабылдау 20 пайыздық тармақтан астамға артты, ал бақылау тобында өзгерістер минималды болды.

Ағылшын тіліндегі мәтіндерді, терминологиялық глоссарийлерді, мультимедиялық ресурстарды және топтық талқылауларды кіріктіру студенттер үшін жаңалық пен қиындық элементін тудырып, стандартты биология сабақтарын тартымды, интерактивті және тәжірибелік тұрғыдан маңызды етіп түрлендіргеніне ерекше назар аударылған. Анкеталық деректердің мазмұндық талдауы студенттердің CLIL-ді тек тілді үйрену құралы ғана емес, сонымен бірге биологиялық процестер мен кәсіби тұрғыдан маңызды тақырыптарды терең түсінуге арналған тиімді құрал ретінде бағалағанын растады.

Бұл мақала колледж оқытушыларына, оқу бағдарламаларын жасаушыларға және білім беру зерттеушілеріне қызықты болады, өйткені онда CLIL технологиясының статистикалық тұрғыдан маңызды әсерлері ғана емес, студенттердің тікелей әсерлері де баяндалады, мотивация мен қызығушылықтың табысты оқудағы рөлі ерекше атап өтіледі. Зерттеу биологияны оқытуды заманауи, тартымды және болашақ мамандарды кәсіби даярлауға сәйкес етуге мүмкіндік беретін көптілді интеграцияланған әдістерді енгізу үшін тәжірибелік нұсқаулық әрі мықты дәлел ретінде қызмет етеді.

Кілт сөздер: CLIL, биология, колледж, көптілді білім беру, студент мотивациясы, тартылу, инновациялық әдістер.

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Влияние технологии clil на мотивацию и учебные достижения студентов колледжа при изучении биологии

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В условиях глобализации и стремительного развития многоязычной образовательной среды преподавание биологии в колледже сталкивается с важной задачей: не только передавать предметные знания, но и развивать у студентов критическое мышление, коммуникативные навыки и языковую компетенцию. В статье рассматривается применение технологии CLIL (Content and Language Integrated Learning) как инновационного подхода, сочетающего освоение биологического содержания с изучением английского языка. Проведённое среди студентов первого курса колледжа исследование показало впечатляющие результаты: в экспериментальной группе уровень вовлечённости в занятия, удовлетворённости форматом обучения и восприятия полезности материала вырос более чем на 20 процентных пунктов, тогда как в контрольной группе изменения были минимальными.

Особое внимание уделено тому, как интеграция англоязычных текстов, терминологических глоссариев, мультимедийных ресурсов и групповых обсуждений создала для студентов элемент новизны и вызова, превратив стандартные уроки биологии в увлекательные, интерактивные и практически значимые занятия. Мазмұнный анализ анкетных данных подтвердил, что студенты оценили CLIL не только как средство изучения языка, но и как эффективный инструмент для более глубокого понимания биологических процессов и профессионально значимых тем.

Статья будет интересна преподавателям колледжей, разработчикам учебных программ и исследователям образования, поскольку в ней раскрываются не только статистически значимые эффекты применения технологии CLIL, но и непосредственные впечатления студентов, подчёркивается роль мотивации и интереса в успешном обучении. Исследование служит практическим руководством и весомым аргументом в пользу внедрения интегрированных многоязычных методов, которые делают преподавание биологии более современным, привлекательным и соответствующим требованиям профессиональной подготовки будущих специалистов.

Ключевые слова: CLIL, биология, колледж, многоязычное образование, мотивация студентов, вовлечённость, инновационные методы.

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ТЕОРЕТИЧЕСКИЕ ОСНОВЫ ТЕХНОЛОГИИ 5E В STEAM-ОБРАЗОВАНИИ

В этой статье рассматривается использование технологии 5E (Вовлечение, исследование, объяснение, разработка, оценка) STEAM образования. Технология применялась на различных занятиях некоторых стран как эффективное средство развития критического мышления учащихся. Представлены теоретические основы данной педагогической модели, ее интеграция с междисциплинарным подходом STEAM (наука, технология, инженерия, искусство, математика), а также результаты практической реализации в средних школах и колледже различных стран. В ходе исследования было выявлено, что внедрение технологии 5E способствует активному вовлечению школьников в учебный процесс, развитию аналитических и исследовательских навыков, а также формированию устойчивого интереса к естественнонаучным дисциплинам. Сделан вывод о том, что систематическое применение данной методики необходимо для повышения качества химического образования и развития интеллектуального потенциала школьников.

Ключевые слова: STEAM-образование, модель 5E, критическое и креативное мышление, химия.