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GAMIFICATION IN BIOLOGY EDUCATION: HOW GAMING TECHNOLOGIES INCREASE STUDENT MOTIVATION

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Summary

Modern education actively uses digital technologies, including gamification, as a tool for increasing student motivation. This article discusses the basic principles of gamification in teaching biology, examples of successful gaming techniques, and their impact on student engagement and academic performance. The purpose of this article is to analyze the impact of gamification on student motivation in studying biology. In the context of modern education, the use of gaming technologies is particularly relevant, as it helps to increase student engagement and academic performance. The article discusses the basic principles of gamification, examples of successful gaming techniques, and their impact on the educational process. A study that included a questionnaire and analysis of academic performance showed that gamification helps to increase motivation by 35% and improve memorization of terms by 28%. The benefits and challenges of introducing gaming elements are discussed, as well as recommendations for their effective use.

Keywords*: gamification, gaming technologies, student motivation, biology education, digital platforms, interactive learning.*

Introduction. Gamification is the process of introducing game elements into a non-game environment, including education [1, 2]. In the context of increasing volumes of information and decreasing attention spans of students, gaming technologies are becoming an effective tool for engaging and improving the assimilation of material [3]. In biology, as a science that requires not only theoretical knowledge but also practical skills, the use of gaming methods is especially relevant [4, 5].

Historically, the use of game elements in education goes back to ancient pedagogical methods, such as staged games and theatrical performances in education [6]. In the 20th and 21st centuries, with the development of computer technologies, the first educational games emerged, which over time evolved into full-fledged digital platforms [7, 8]. Today, gamification covers a wide range of educational disciplines, including biology, where it is used to model ecosystems, study anatomy and biochemical processes [9, 10].

Technological development has made it possible to create innovative teaching methods, including virtual laboratories, mobile applications, and online platforms with gamification elements [11]. This article discusses the mechanisms for introducing gaming methods into the educational process, their advantages, and potential difficulties in implementation [12, 13].

Materials and methods. The following methods were used to analyze the effectiveness of gamification in teaching biology [14, 15]:

Literature analysis: modern research and articles on gamification in education, its impact on student motivation and learning effectiveness were studied. A detailed analysis of publications over the past ten years was conducted, which made it possible to identify the main trends and directions for the development of this methodology.

Experimental learning: training sessions with gamification elements were conducted, including the use of educational applications, virtual laboratories, role-playing and board games, as well as modeling of biological processes in interactive environments. As part of the experiment, students completed several thematic blocks containing both traditional and game elements of learning,

which made it possible to objectively compare the results.

Questionnaires and surveys: data were collected on students' perception of gaming technologies, their motivation, involvement in the educational process and satisfaction with the educational process. The study involved 200 students majoring in biology aged 18 to 25 years. The survey included questions aimed at identifying subjective attitudes towards gamification, as well as analyzing the impact of game mechanics on interest in the subject.

Comparative analysis of academic performance: changes in the academic performance of students who participated in gamified courses were assessed compared to the control group. The results of midterm and final tests, as well as the dynamics of class attendance, were used for the analysis. This analysis allowed us to identify a correlation between the use of gaming technologies and academic performance.

Qualitative analysis methods: interviews were conducted with teachers using gaming technologies in order to identify their perception of the effectiveness of this approach and identify possible barriers to the implementation of gamification. The interviews included both structured questions and free discussion of the experience of implementing gaming methods.

The data were processed using statistical analysis methods, including the calculation of mean values, standard deviations, and correlation analysis to determine the relationship between the level of student engagement and their academic success. In addition, a content analysis of students' comments was conducted, which made it possible to identify key factors influencing the effectiveness of gamification.

Basic principles of gamification in teaching biology [16, 17]

1. Use of game mechanics: points, levels, achievements, leaderboards, badges, and rewards encourage students to actively participate.

2. Storytelling and interactivity: inclusion of elements of quests, role-playing games, and simulations makes the learning process more engaging and closer to real conditions.

3. Feedback and encouragement: immediate feedback in the form of rewards or comments allows students to correct mistakes and feel satisfied with their progress.

4. Competitive element: competitions between students or team games motivate students to study the material and develop analytical skills.

5. Adaptability: the ability to adjust the difficulty of tasks and a personalized approach makes learning more effective and accessible to students of different levels.

6. Interactive interaction: the inclusion of joint projects, group games and tasks helps students work in a team and solve complex biological problems.

Examples of gaming technologies in biology education [18, 19]

1. Educational applications: platforms Kahoot!, Quizlet, Biomania offer interactive tests and quizzes for memorizing terms, functions and processes.

2. Virtual labs: online simulators such as Labster allow you to conduct biological experiments in a safe digital environment, simulating real laboratory conditions.

3. Quests and scenario games: conducting field research in the format of "search for clues" or laboratory work with detective elements promotes engagement and increases interest in scientific research.

4. Board and card games: using cards with tasks, biological terms or DNA chains helps to memorize the material in a playful way.

5. Role-playing games and simulations: students can play the roles of scientists, researchers or biologists, simulating real-life scenarios of scientific work.

6. Online ecosystem simulators: programs that simulate processes in ecosystems help students study the influence of various factors on nature and the development of organisms.

Results and discussion. The study included a series of lessons with elements of gamification and traditional learning. The analysis showed that students who used game methods demonstrated:

• Increased engagement (35% higher compared to traditional methods);

• Improved memorization of terms and concepts (28%);

• Higher activity in discussions and group

work;
• Increased satisfaction with the learning process.

According to the testing results, students who studied using game methods scored on average 15% more points than those who took the course without gamification.

Table 1. Comparative analysis of students' academic performance and engagement

Group of students	Average test score	Engagement level (%)
Traditional learning	70	55
Gamified learning	85	90

The results of the study confirm the effectiveness of gamification as a method of teaching biology. Game mechanics not only increase motivation, but also contribute to better assimilation of the material. However, for successful implementation, it is necessary to adapt the methods to a specific audience and the educational process.

Conclusion. Gamification in teaching biology is a promising direction that can significantly increase student motivation. The use of game methods not only makes the educational process more interesting, but also improves the quality of knowledge acquisition. However, it is necessary to take into account the balance between the game and the academic component in order to ensure high efficiency of training.

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Биология біліміндегі геймификация: қалай ойын технологиялары оқушылардың мотивациясын арттырады

Аңдатпа

Заманауи білім беруде оқушылардың мотивациясын арттыру құралы ретінде цифрлық технологиялар, оның ішінде геймификация белсенді түрде қолданылады. Бұл мақалада биология бойынша білім берудегі геймификацияның негізгі принциптері, сәтті ойын әдістерінің мысалдары және олардың оқушылардың сабаққа қатысуы мен үлгеріміне әсері қарастырылады. Бұл мақаланың мақсаты биологияны оқудағы оқушылардың мотивациясына геймификацияның әсерін талдау. Заманауи білім беру жағдайында ойын технологияларын қолдану әсіресе өзекті болып отыр, өйткені ол оқушылардың белсенділігі мен оқу үлгерімін арттыруға көмектеседі. Мақалада геймификацияның негізгі принциптері, сәтті ойын әдістерінің мысалдары және олардың оқу процесіне әсері қарастырылған. Сауалнамалар мен өнімділікті талдауды қамтитын зерттеу геймификация мотивацияны 35%-ға арттырып, терминдерді еске түсіруді 28%-ға жақсартқанын көрсетті. Ойын элементтерін енгізудің артықшылықтары мен қиындықтары, сондай-ақ оларды тиімді пайдалану бойынша ұсыныстар талқыланады.

Түйінді сөздер*: геймификация, ойын технологиялары, оқушылардың мотивациясы, биологиялық білім, цифрлық платформалар, интерактивті оқыту.*

Материал баспаға 02.09.24 түсті

Геймификация в обучении биологии: как игровые технологии повышают мотивацию студентов

Аннотация

Современное образование активно использует цифровые технологии, включая геймификацию, как инструмент повышения мотивации студентов. В данной статье рассматриваются основные принципы геймификации в обучении биологии, примеры успешных игровых методик, а также их влияние на вовлеченность и успеваемость студентов. Целью данной статьи является анализ влияния геймификации на мотивацию студентов при изучении биологии. В условиях современного образования использование игровых технологий приобретает особую актуальность, так как способствует повышению вовлеченности и успеваемости учащихся. В статье рассматриваются основные принципы геймификации, примеры успешных игровых методик и их влияние на образовательный процесс. Исследование, включающее анкетирование и анализ успеваемости, показало, что геймификация способствует повышению мотивации на 35% и улучшению запоминания терминов на 28%. Обсуждаются преимущества и вызовы внедрения игровых элементов, а также рекомендации по их эффективному применению.

Ключевые слова: *геймификация, игровые технологии, мотивация студентов, биологическое образование, цифровые платформы, интерактивное обучение.*

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Conflict of interest. The authors declare no conflict of interest.