Journal of Ecohumanism
2024
Volume: 3, No: 8, pp. 1330– 1344
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i8.4814

Effectiveness of the Gamification Method in the Process of Phenomenon-Based Learning in Secondary School (in the Example of Kazakhstan)

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Abstract

In today's educational environment, it is essential to introduce innovative methods to increase students' activity and improve learning results. In this study, a detailed examination of domestic and foreign literature is conducted to analyze gamification's effectiveness and specific aspects in various educational settings. The main goal of the study is to evaluate the effectiveness of gamification in the educational system of Kazakhstan, paying special attention to the use of gamification in teaching physics. To achieve this goal, mixed methods were used, including qualitative and quantitative analysis. The survey involved 59 randomly selected students of 8 and 10 grades of general education schools in Kazakhstan and studied a set of tasks related to the game in the classroom. The results of the survey showed that gamification is accepted as an effective method in the teaching of physics in the Kazakhstan education system. Pupils' attitudes towards game-based learning were positive, indicating an improvement in their motivation and engagement levels, as well as an improvement in their understanding of physics. To increase student engagement in STEM subjects, educators should consider incorporating gamification into the curriculum.

Keywords: *Teaching In Secondary School, Gamification Method, Physics Education, Innovative Teaching Methods, Education in Kazakhstan, Level of Motivation.*

Introduction

The 21st century is a time of development of innovations and digital technologies worldwide. In the developed countries of Japan, the USA, and Korea, technology is flourishing and economic growth is being stimulated. " First of all, this requires new changes in education in accordance with the modern requirements. Today, digital technologies have become an integral part of the everyday life of schoolchildren. This causes the problems of students' use of telephone and Internet networks for games and movies, which reduces their motivation to study. Any teacher should be able to effectively convey knowledge and enrich the scientific worldview while awakening the student's interest in the subject. With this in mind, teachers have to deal with important challenges related to the learning process and adapting to students with different learning styles and new teaching demands.

Traditional approaches to teaching physics cannot fully meet the requirements of educational standards, according to the obligations set out in the "State program for the development of education and science in the Republic of Kazakhstan for 2020-2025" (Republic of Kazakhstan, 2020). Simple technology may not be able to solve this problem and provide students with deep and meaningful learning experiences. That's why advanced educators need to introduce engaging learning experiences - innovative methods and ideas - to make lessons interesting for students. However, this shows that traditional methods should not be completely discarded, but should be used in harmony with new technological methods.

Innovative teaching is the use of new and creative methods in the process of education and training. It focuses on introducing new ideas, technologies, strategies, and methods to improve the learning experience. For this purpose, there are many types of innovative teaching methods that teachers can use. According to

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the peculiarities of modern education, their widely used types include the following (Figure 1) (GoBookMart, n.d.):

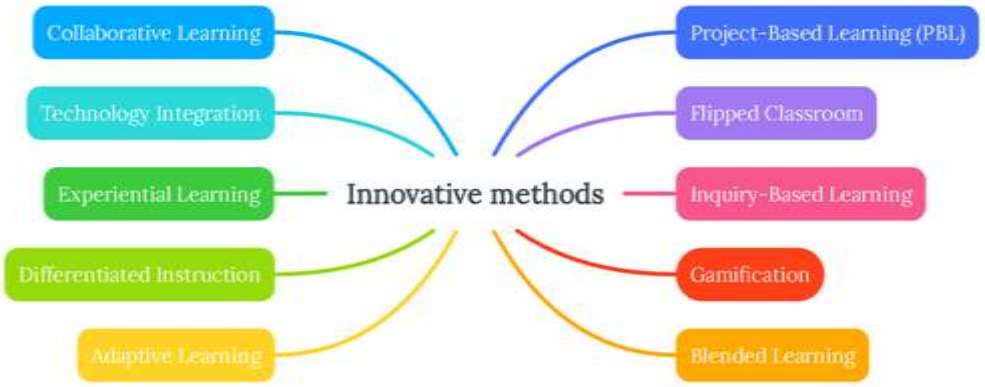

Figure 1. Types of Innovative Methods

Different types of innovative teaching methods are used for several reasons, aimed at enhancing the overall learning experience and better preparing students for the challenges of the modern world. The main reasons for using different types of innovative teaching methods:

satisfying different learning styles and preferences of students;

arousing and stimulating the interest of students;

development of critical thinking;

preparing students for the future, adapting them to world changes;

support for lifelong learning;

improve memory;

satisfaction of personal needs;

adapting students to technological advances.

Thus, the use of various types of innovative teaching methods stems from the need to create a dynamic, engaging, and effective learning environment that equips students with the skills and knowledge needed to succeed in the 21st century.

In recent years, one of the innovative methods - gamification - has been used as a powerful way to increase activity and motivation in various fields, including education. Gamification is based on the principles of game design. It applies game elements and mechanics to non-game contexts, such as educational settings. The use of gamification in education is gaining significant attention as it transforms the traditional learning environment to promote a more effective and enjoyable learning experience for students.

Accordingly, this article examines the impact of gamification on physics education in the context of Kazakhstan, which has a rich cultural heritage and a rapidly developing educational landscape. Examining the implementation of gamification strategies in the learning process, we aim to evaluate their effectiveness in increasing student motivation, engagement, and general understanding of physics concepts.

Gamification engages students in learning physics, challenging the notion that school physics is a “bunch” of meaningless formulas. In addition, the school and the student provide a functional connection between

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their daily experiences through repeated interactions with new technologies such as computer games and smartphones (Ferreira, W. S., Ferreira, W. S., & Ferreira, S. R., 2019).

This method is very effective for 7th and 8th graders who have just started studying physics. This is because the main purpose of using gamification is to attract students to the learning and teaching process by awakening their interest (W.**S** Ferreira et al.**,** 2019).

Literature Review

The application of game elements and mechanics in a non-game context, known as gamification, has gained significant attention in the field of education in recent years. In particular, it shows good results in improving physics teaching and learning. Proof of this is that according to the statistics of the use of gamification in education, global gamification is estimated at 860.13 million dollars in 2021. In addition, more than a third of teachers worldwide (38%) use digital games in the classroom every week (Soocial, n.d.). Accordingly, this literature review aims to investigate the use of gamification in physics education and evaluate its effectiveness in increasing student engagement, motivation, and learning outcomes.

The successes and challenges of gamification in different countries are actively discussed in foreign literature. Studies have proven positive results such as increased motivation, improved academic performance, and improved critical thinking. However, the differences in their results highlight the importance of considering the cultural and educational circumstances of each country.

The term "gamification" was first introduced into science in 2002 by Nick Pelling (born 1964), a British computer programmer and recognized as the father of gamification. Since 2003, studies focused on game design have been conducted. And the use of gamification in the field of education, especially in the e-learning environment, has grown exponentially since 2014 (Ebner & Holzinger, 2007; Simões, Redondo, & Vilas, 2013; Torres-Toukoumidis, Ramírez-Montoya, & Romero-Rodríguez, 2019). The period of greatest use of this method began in 2019, as it gained attention as one of the solutions to the educational problems caused by COVID-19.

The increase in demand due to the use of the gamification method in education can be observed according to the statistical data obtained from the Google Trends (https://trends.google.com/) website (Figure 2). This data shows the growth in the number of searches worldwide for the keyword "Gamification in education" between 2010 and 2024.

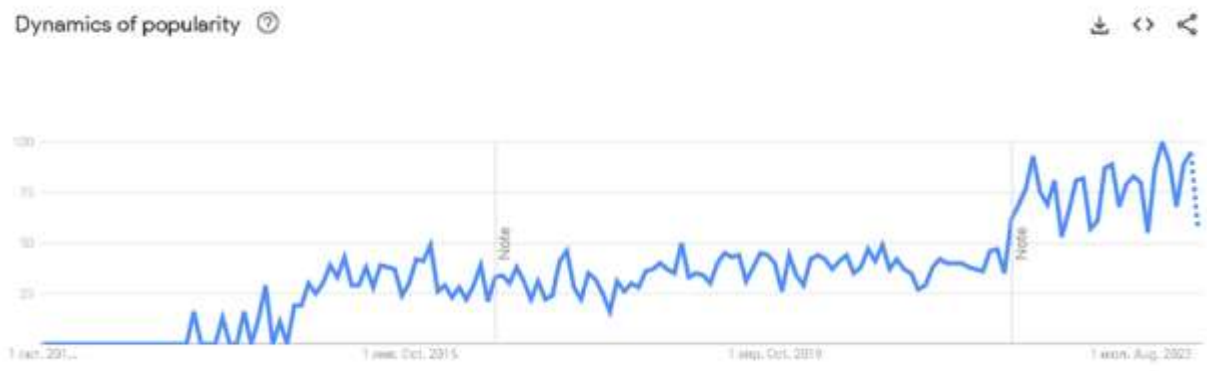

Figure 2. Indicators Of Interest in The Term "Gamification In Education" From 2010 To 2024 According To Google Trends

In addition, the Google Scholar site shows that in recent years there has been a growing interest in scientific research on gamification. The statistics of articles searched for the keyword "Gamification in education" between 2014 and 2024, presented below, show that research articles related to gamification have increased over time.

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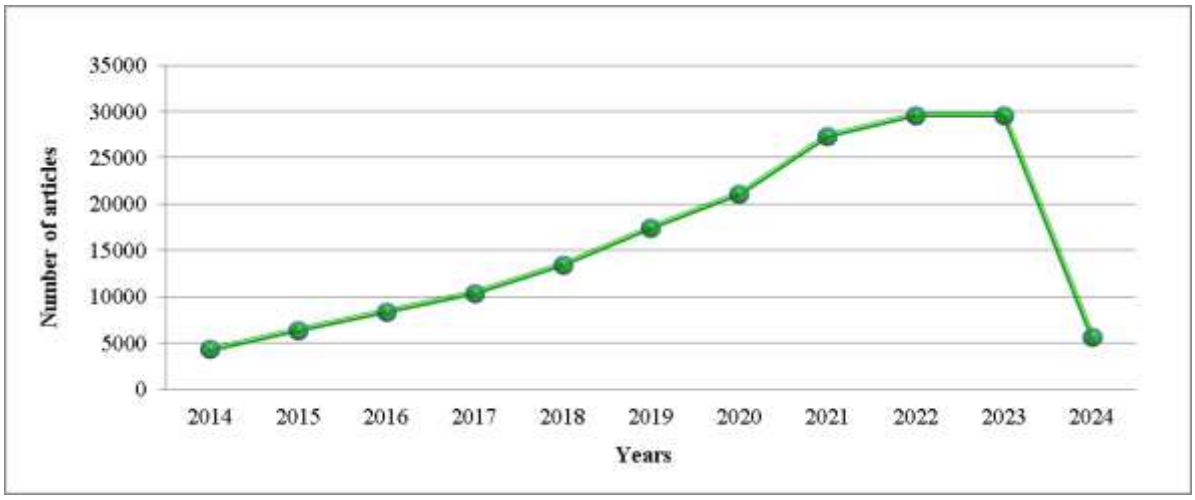

Figure 3. According To Google Scholar, Indicators Of Academic Interest In The Topic Of "Gamification" Over The Last Ten Years

Even though 2024 is only three months into the year, the total number of articles published during this period was 5,700.

According to the gamification method, game elements and mechanics are used in non-game contexts in business management, marketing, healthcare, and education (Deterding, Dixon, Khaled, & Nacke, 2011). In education, the term "Gamification" is described in the scientific literature as strategies and methodologies that include the ways and possibilities of using different types of games in teaching-learning (TL) processes (Perrotta, Featherstone, Aston, & Houghton, 2013; Shaffer, Squire, Halverson, & Gee, 2005). Using quizzes, game rules, time limits, punctuation, badges, scores, leaderboards, virtual currencies, and many other game elements, teachers turn their classrooms into game environments to encourage student motivation, action, and feedback (Groff, Howells, & Cranmer, 2010; Hamari, Koivisto, & Sarsa, 2014; Gil, Cantador, & Marczewski, 2015). At first, gamification was considered to be the addition of certain elements of the game to the lesson, but nowadays computer games and programs are used in the lessons. Оқытуда геймификацияны қолдану оқушылардың ынтасын және қатысуын арттырады, сонымен қатар оқушылардың қарым-қатынасын жақсартады (Majuri, Koivisto, & Hamari, 2018).

In addition, gamification reduces the stress associated with online learning in students and increases their interaction and concentration (Fontana, 2020). Educational content transformed into an online game provides students with new learning experiences through game mechanics and rules, and increases their motivation, interest in participation, and improves their attitude toward learning (Kim, 2013).

Although gamification in e-learning has only recently been used, it has been widely studied and discussed in the literature in several fields such as mathematics, social sciences, engineering, health care, environment, etc. (Alshammari, 2019; Wautelet, Kolp, & Neysen, 2012; de Marcos Ortega, García-Cabo, & López, 2017; Romero-Hernandez et al., 2018; Manzano-León et al., 2021). The focus of gamification in the learning process has always been to promote behavior change and increase motivation, engagement, and satisfaction to promote a sustainable environment or increase interest in learning in a general education context.

The lack of rigorous research makes it difficult to determine whether gamification improves student learning beyond simply increasing fun and motivation in the classroom. If gamification does not significantly improve learning but simply improves classroom climate and student motivation, it would be a great achievement (Looyestyn et al., 2017; Buckley & Doyle, 2016).

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In addition, teachers nowadays use real-time feedback platforms such as "Kahoot!" and "Socrative" to save time, apart from simple game elements in the classroom. Their effectiveness lies in the fact that they cover a lot of things that interest students and allow them to get their results instantly and easily in an Excel-like spreadsheet. On these platforms, it is possible to provide immediate feedback to both the teacher and the students (Looyestyn et al., 2017; Buckley & Doyle, 2016; Chickering & Gamson, 1987). Hernández-Fernández (2020) distinguishes several levels of gamification depending on the use of classroom time for teachers (Table 1).

Table 1. Levels of Gamification (Hernández Fernández, 2020)

Levels of gamification			
The level of gamification	**Definition and scope of application**	**Assessment**	**Example**
0% Specific gamification	Teachers use a certain game in real activities. Ideal for teachers who are short on time or want to start gamification with external assessment that is not directly dependent on assessment.	Grades for games are assigned to class activities that are part of the continuous assessment of the lesson and have less weight than the final grade of the subject, usually, no more than 10% of the total lesson, because there are other projects, assignments or exams that have a higher weight.	Special Kahoot or Socrative tests to test content assimilation or specific actions. Tests in external contexts outside the regular classroom.
Partial gamification	Teachers decide that part of the subject will be taught through games, but not all, mostly combining games with other mechanisms and pedagogical methods. An intermediate, flexible system that does not completely abandon traditional non-gamified elements, combining games with regular projects, exams, and activities.	A significant percentage of the subject (20–80%) is assessed with games, which are another ingredient of the applied methodologies. Because of the percentage that play assumes in assessment, we approach gamification in general and students can have a very high sense of play.	Assessment of all learning through game tests. Gamified oral presentations.
General gamification 100%	A whole subject can be made up of different games that can be used to assess all competencies. Special and partial gamification is offered only to teachers who have sufficient experience in gamification or who meet the course specifications	Game scores and achievements account for 100% of the grade, so they must be "transferred" into official grades at the end of the course. Ideal for courses that are graded through projects or where students can choose to	Test-based learning. Final exams are supported by continuous assessment of play activities. The final exam remains a

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	(workshops and practical courses).	grade a final exam or course game.	remediation for those who failed.

The use of gamified methods in the classroom does not mean a departure from the "authenticity" of the theoretical content of the subject. A game is not a meaningless approach, on the contrary, students appreciate the closeness between game fiction and real-life experiences. They ensure that the game is not too detached from reality, does not mislead in the narrative, and does not lead to screen addiction, which is especially important in science.

To make real or partial gamification of their subjects very simple, teachers consider games as an additional component of a hybrid teaching approach (Lam, Hew, & Chiu, 2017; Hernández Fernández, 2020).

The transition to full gamification is a complex step because it can be achieved gradually after the teacher feels safe and comfortable using this new thing in the subject when partial gamification goes beyond certain simple games, and when it is clear that he can properly evaluate (Hernández Fernández, 2020). That is, the teacher can introduce gamification into the lesson based on his and the student's experience. Also, applying full gamification to students right away is a misstep.

Methods

To compare the implementation and effectiveness of gamification in teaching physics in Kazakhstan and other countries, a comprehensive review was made. Searches were conducted in major academic databases, including Google Scholar, Scopus, and additional international education databases. The search included articles published from 2008 to 2023 and used keywords such as 'gamification' and 'education in physics,' along with the names of specific countries (e.g., Kazakhstan, the USA, Germany, Japan).

For more than a decade, researchers have studied the use of games in education and have concluded that they are an effective teaching tool. Studies at various academic levels such as elementary school (Lee et al., 2004), middle school (Kebritchi, Hirumi, & Bai, 2008), college (Coller & Shernoff, 2009) and biology (McClean et al., 2001), programming (Moreno, 2012), and electromagnetism (Squire et al., 2012) have shown that games can be used to increase student engagement and learning outcomes. Based on these pedagogical advantages, gamification was soon used in education to engage students.

Currently, it is very important to implement gamification in education in alignment with students' interests and characteristics. This is because they belong to Generation Z (born around the late 1990s to early 2010s) and Generation Alpha (born from the early 2010s to mid-2020s), which are different in time from their predecessors.

They are:

- Generation Z is made up of socially conscious and tech-savvy youth who grew up with social media and cell phones. They value authenticity in their relationships, value diversity and fairness, and enjoy the fast-paced dynamics of modern life.

- Alpha generation - accustomed to living in constant connection with smartphones, tablets, and the Internet. They like fast-paced activities, are very adaptable, and may even start their own business at a young age. They are always aware of the latest developments in technology and strive to make an effort to improve the world.

It is very effective to implement gamification according to the characteristics of the representatives of this generation through various educational platforms. This suggests that gamification strategies should be activated in the implementation of educational practices. Platforms where educational gamification is used may include websites, software applications, or online tools specifically designed to introduce game-like features into the learning experience. In these services, students learn by watching online videos and doing exercises, and their progress is monitored through scores and collection points (Barata et al., 2016).

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Although there is no official list of elements used in such platforms, the following can be mentioned as the most common ones (Crumlish & Malone, 2009; Kim, 2008; Werbach et al., 2012; Zichermann & Cunningham, 2011; Lewis et al., 2012; Hamari et al., 2014):

- experience points and levels used primarily to provide feedback and monitor progress;
- challenges or quests that have specific goals, track progress, and train users for more challenging activities;
- badges, collectible artifacts aimed at increasing the motivation of the user by developing and stimulating their natural abilities;
- leaderboards that increase competitiveness and encourage users to continuously strive to achieve their desired ranking.

Whether or not to use leaderboards in gamification is one of the most controversial issues, as most students who get low positions usually lose motivation. Despite this, studies of leaderboards in gamified environments have found no significant negative effects on participants' motivation (Mekler et al., 2013; Aguilar, Holman, & Fishman, 2014).

Some of these platforms are popular with the masses and some are not so popular.

There are many game-based learning platforms for physics that can be effectively used to provide students with an interactive and engaging experience in learning physics. We have collected several types of game platforms that can be used in physics teaching through research on Google Scholar (Table 2).

Table 2. Platforms Used in Physics Education

Name	Type	Description
Kahoot!	Quiz based	Teachers can create interactive quizzes, polls, and discussions using the popular quiz platform Kahoot!. It adds leaderboards and a competitive component to make the learning process feel like a game.
Quizizz	Quiz based	Like Kahoot!, instructors can create and share quizzes on Quizizz. It has several elements, including a game point system, self-learning, and real-time feedback. Students can participate both individually and in groups.
PhET Interactive Simulations	Based on simulation	Physics concepts can be learned through interactive simulations offered by PhET. Through hands-on exploration, these simulations help students better understand abstract physics concepts by allowing them to explore different factors.
Socrative	Quiz based	Socrative is an online educational platform for interactive quizzes, assessments, and activities. Students can answer questions in real-time and provide immediate feedback to teachers. Socratic is often used for formative evaluation, participation activities, and measuring student understanding in the classroom or remotely.
Physlet Physics	Interactive physics applets	Physlet Physics provides a collection of interactive physics applets for illustrating various concepts. These applets allow students to manipulate variables, observe changes, and deepen their understanding of physics principles.
Sphero Edu	Robotics and Coding	Sphero Edu combines physical computing with coding. Students can program Sphero robots to perform physical experiments, teaching concepts such as motion, velocity, and acceleration in a hands-on and interactive way.

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Gizmos by ExploreLearning	Based on simulation	Gizmos offers an interactive library of scientific and mathematical simulations, including physics. By allowing students to explore and manipulate variables in virtual experiments, these simulations help them better understand fundamental ideas in physics.
Labster	Virtual laboratories	Labster offers virtual labs that simulate real-world experiences. Students can conduct experiments in a virtual environment, making it a valuable resource for teaching physics laboratory concepts.
Classcraft	Role playing game (RPG)	A gamified educational technology platform called Classcraft makes learning fun in the classroom. Using game features such as quests, points, avatars, and prizes allows teachers to design dynamic and engaging learning environments.
Edpuzzle	Based on video	With Edpuzzle, teachers can play video content by adding stories, questions, and quizzes. Through interactive video courses, this platform enables teachers to assess students' level of understanding and engagement.

Despite the many benefits of gamification in education, some researchers point out that it has disadvantages. Mayer R.E (2014) stated that students are less enthusiastic about the gamification method, and their motivation to study is weak because they are not ready for this method. Lam Y.W, Hew K.F, and Chiu K.F (2017) say that learning through games can create a group of students who do not respect teachers due to the lack of face-to-face communication between students and teachers. Also, some researchers say that students feel uncomfortable in front of others and are afraid of making mistakes because they think that their friends will laugh at their mistakes (Nasrullah & Rahman, 2018).

Mobile phone use among teenagers is widespread worldwide, and Kazakhstan is no exception. In 2022, according to the data of the Statista Foundation, the penetration rate of smartphones in the world increased from 70%. With the increasing availability of smartphones and the Internet, it can be assumed that a significant number of teenagers in Kazakhstan use mobile phones for various purposes such as communication, social media, education, and entertainment. Because of this, education will need to use a more effective method - gamification - rather than trying to tear teens away from their smartphones.

American Aaron Smith and Shane Brauer (Smith & Brauer, 2018) conducted a study to evaluate the effectiveness of gamification for the "Thermodynamics" section of physics. They used the online quiz game platform Kahoot! (Figure 4) in their research.

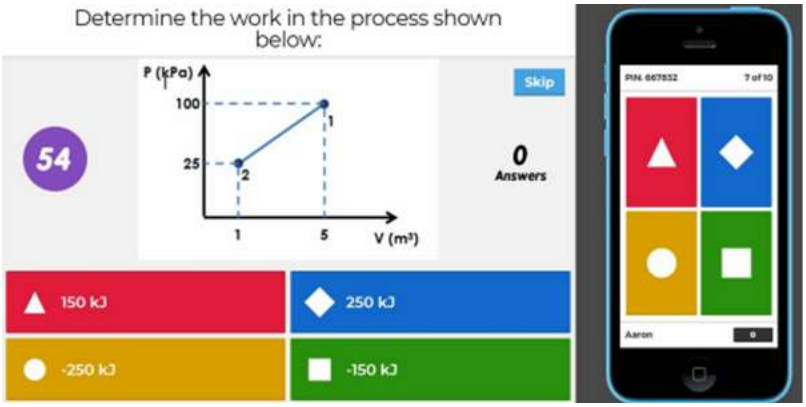

Figure 4. Kahoot! Quiz Question Sample and Student Game Screen

However, they used Kahoot! gamification in combination with traditional methods, that is, the topic was explained to the students in advance. After the unit was taught, a voluntary online survey was conducted to determine students' understanding of playing Kahoot! quizzes during the lesson. 20 out of 28 students who

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studied the unit participated in the survey. The results of multiple choice questions are presented in Table 1.

According to the survey results (Table 4) and observations of students using gamification, well-designed Kahoot! questions can lead to improved student engagement, motivation, and learning performance. However, it was ensured that the questions required special attention to the response time.

Table 3. Summary of Student Survey Responses

	I completely disagree	I do not agree	I agree	I completely agree
The Kahoot! quizzes helped me better understand the concepts in this section	0	0	13	7
Kahoot! quizzes were fun to play. I always looked forward to playing.	0	1	10	9
I tried hard to get the right answer on Kahoot! quizzes	0	0	17	3

In addition, Vanie Y. Benben*, Mary Allein Antoinette C. Bug-o (2022) from the Philippines conducted a study related to the use of Quizizz in education. The experiment on gamification was conducted about the chapters taught in the 4th quarter of the 10th-grade physics subject. Before and after using gamification, tests were taken to determine students' academic achievements and motivation levels.

Table 4. Level of Academic Achievement Before and After Gamification

Academic achievement level	**Testing (before gamification)**		**Posttest (after gamification)**	
	f	%	f	%
Very High (VH)	-	-	1	2.8
High (H)	-	-	2	5.5
Medium High (MH)	-	-	9	25.0
low (L)	-	-	14	38.9
very low (VL)	36	100.0	10	27.8
total	**36**	**100.0**	**36**	**100.0**

Table 5. Motivation Levels Before And After Gamification

level of motivation	**Before gamification**		**After gamification**	
	f	%	f	%
Very High (VH)	2	5.6	11	30.6
High (H)	14	38.9	10	27.8
Medium High (MH)	12	33.3	10	27.8
low (L)	7	19.4	3	8.3
very low (VL)	1	2.8	2	5.5
total	**36**	**100.0**	**36**	**100.0**

Above (Table 4) and (Table 5) comparing the results before and after using gamification for students, it can be seen that the use of Quizizz had a positive effect on the motivation and academic achievement of students.

Can the use of the same gamification be effective in education in Kazakhstan schools? To get an answer to this question, an experiment was conducted in one randomly selected school of Kazakhstan, related to the use of the gamification method. 59 respondents of 8th and 10th-grade students participated in the study and the lessons were conducted on the chapter on "Direct Electric Current". The research was conducted

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in January-February 2024. Unlike the above studies, different platforms were used in education, not just one program. These included PhET Interactive Simulations, Quizizz, Kahoot!, and others.

In this study, a survey method was used after the completion of the chapter for the students, that is, questions were posted on Google Forms and distributed through WhatsApp and Telegram. Before the questionnaire was presented to the students, the concept of gamification was explained. In addition, the definition of this concept was shown in the initial part of the survey.

Survey questions:

Do you like learning physics through gamification?

- Yes
- No

Has gamification made learning physics more interesting for you compared to traditional (simple) teaching methods?

- Yes
- No

How do you rate your overall understanding of physics concepts after learning through gamification compared to traditional learning methods?

- Good
- Average
- Bad

Has gamification improved your physics problem-solving skills?

- Yes
- No

Would you like to include gamification elements in future physics lessons?

- Yes
- No

How has gamification affected your interest in furthering physics?

- Increased
- Decreased
- Did not change

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Results

The results of the survey were as follows:

For question 1, 94.9% of students answered yes and 5.1% answered no. This showed that the vast majority of participants enjoyed learning physics through game elements.

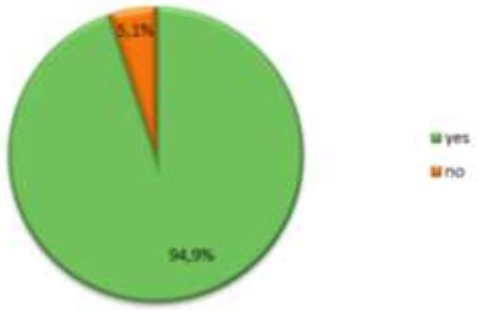

Figure 5. Schematic Diagram of Pupils' Answers to Question 1

For question 2, 88.1% of participating respondents answered yes, while 11.9% answered no.

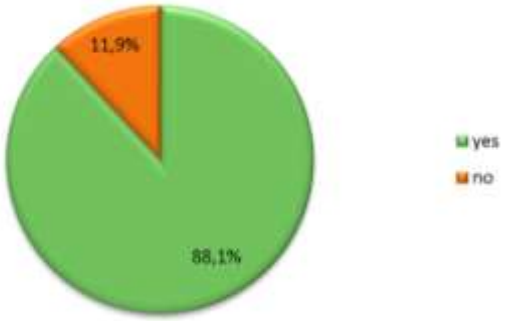

Figure 6. Schematic Diagram of Pupils' Answers To Question 2

In response to question 3, 55.9% of the participating respondents answered that it was good, while 44.1% answered that it was average.

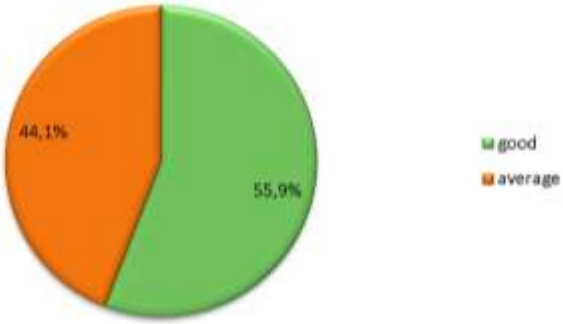

Figure 7. Schematic Diagram of Pupils' Answers to Question 3

For question 4, 86.4% of participating respondents answered yes, while 13.6% answered no.

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ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i8.4814

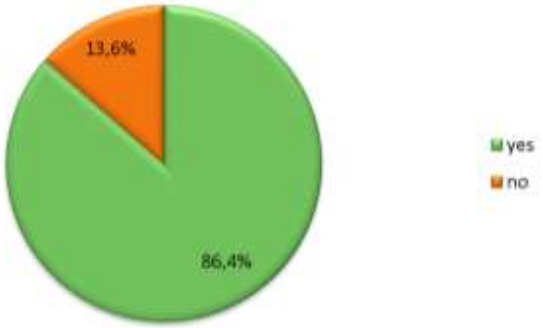

Figure 8. Schematic Diagram of Pupils' Answers to Question 4

For question 5, 86.4% of participating respondents answered yes, while 13.6% answered no.

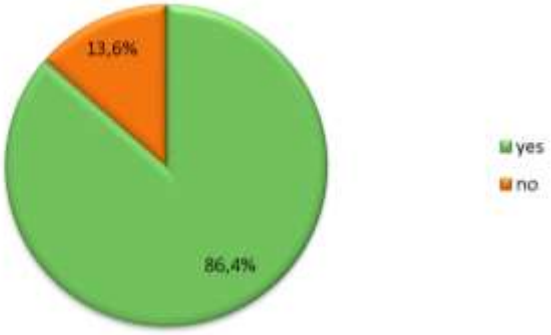

Figure 9. Schematic Diagram Of Pupils' Answers to Question 5

For question 6, 66.1% of the participating respondents answered that their interest in physics increased due to gamification, 8.5% decreased, and 25.4% did not change.

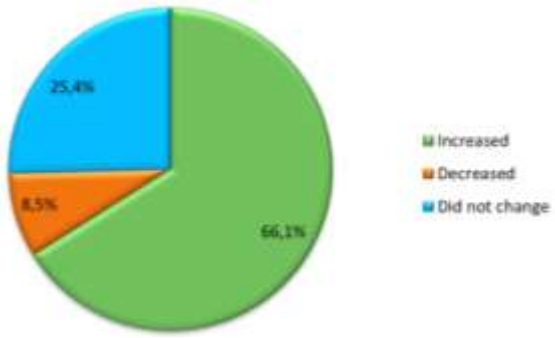

Figure 10. Schematic Diagram of Pupils' Answers to Question 6

The results of the conducted survey showed that gamification as a method of teaching physics was positively evaluated by the majority of students. On the first issue, 94.9% of participants noted that they like learning physics through game elements, which confirms the high degree of attractiveness of this approach. Most of the respondents (88.1%) believed that gamification made the learning process more interesting compared to traditional methods, which indicates the ability of the method to maintain students' interest in the subject.

In addition, 55.9% of students indicated that their understanding of physical concepts improved, and 86.4% indicated that gamification promoted problem-solving skills. This result confirms that game elements in learning can increase not only participation but also learning.

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Regarding the use of gamification in the future, 86.4% of students expressed a desire to see gamification elements in physics lessons. Also, 66.1% of participants reported an increased interest in learning physics, which is an important indicator of the effectiveness of this method in terms of long-term motivation.

Thus, the results of the study confirm that the implementation of gamification in the process of teaching physics significantly increases the level of students' motivation, improves their understanding of the subject, and promotes the development of practical skills. These results highlight the potential for increased use of gamification in educational programs, especially in STEM subjects.

Conclusion

In an era of rapid digital development and innovation, the importance of utilizing modern teaching methods is becoming a key factor in achieving higher education standards. Gamification, as one of the innovative methods, shows its effectiveness in teaching physics, especially in the example of Kazakhstan, where educational reforms play an important role in preparing students for the challenges of the 21st century.

The results of our study confirmed that gamification helps to increase students' interest and motivation in learning physics, which helped to overcome the obstacles of perceiving the subject as complex and unclear. Most students noted that physics lessons with gamification elements are not only more interesting but also allow for a better understanding of the basic concepts of the subject. This demonstrates the possibility of using game elements to create a dynamic and interactive learning environment.

However, it is important to note that gamification should not completely replace traditional teaching methods. The results show that a combined approach - using traditional and innovative methods - can better meet the different needs of students and promote deeper learning. Therefore, gamification can be a powerful tool in the arsenal of teachers seeking to modernize the educational process and improve the quality of physics teaching. Incorporating game elements into the curriculum not only helps students improve academic performance but also helps them develop important skills such as critical thinking and problem-solving. It is important to continue research in this area to maximize the use of gamification in education and maintain high teaching standards in line with global trends.

In conclusion, the study shows a significant positive effect of gamification on student engagement and learning outcomes in physics education, especially in the case of Kazakhstan.

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