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## The impact of gamification on the motivation of primary schoolers under martial law

### Вплив гейміфікації на забезпечення мотивації учнів початкової школи в умовах воєнного стану

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#### Abstract

Ensuring an uninterrupted learning process requires new approaches that will enhance pupil motivation. The aim of the work is to ensure the possibility of including gamification in the learning process of primary schoolers under martial law. This aim was achieved through the use of the methods of questionnaire survey and analysis; calculations of significance, efficiency ratios and Spearman's rank correlation coefficient. The study found that only 19% of teachers used gamification processes before the study. Learning approaches included core material learning through EdApps and Can't Wait to Learn. EdApp and Google Form were used to study basic terminology in the form of a game, do homework, and test knowledge. Dynamism is of the greatest importance for

#### Анотація

Забезпечення безперебійного процесу навчання потребує нових підходів, які сприятимуть мотивації учнів. Мета роботи полягає у забезпеченні можливості включення гейміфікації у процес навчання учнів початкової школи в умовах воєнного стану. Для досягнення поставленої мети в роботі були використані методи анкетування, аналізу; розрахунки коефіцієнтів значимості, ефективності й коефіцієнта кореляції Спірмена. В роботі виявлено, що процеси гейміфікації до початку дослідження постійно використовували лише 19% викладачів. Підходи до навчання включали вивчення основного матеріалу за допомогою застосунків EdApp й «Вивчаю не чекаю». Для вивчення основної термінології в ігровому форматі,

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teachers, as it promotes the participation of all pupils, and affects the development of independence, thinking, and creative skills. The study found that pupils of grades 2-4, who used gamification in their studies, showed a higher knowledge level. It was established that memory and sociability were developed to the greatest extent among schoolchildren. The practical significance of the work is the possibility of transformation of the educational process as a result of the use of the proposed interactive programmes. Prospects of the research may be related to the comparison of the effectiveness of using gamification techniques among primary and secondary schoolers.

**Keywords:** gamification, primary school, group process, game format, pupil motivation, martial law.

## Introduction

The impact of information technologies is also reflected in the educational process, which affects the search for new approaches to teaching the material (Ross & Bennett, 2022). A significant amount of educational information should be presented in a non-standard form, which will make students interested in studying it (Arifin & Setiawan, 2022). Gamification can be applied for easier perception of educational materials, both with and without a combination of innovative technologies (Gupta & Goyal, 2022). The relevance of this research is in the development of new approaches to ensuring the education of primary schoolers using gamification techniques.

Gamification is an approach aimed at using a game format in the educational process, which promotes the activation of intellectual and mental processes of students (Legaki et al., 2022). Gamification affects the socialization of students, which is manifested in the ability to analyse, work in a group without being afraid to express one's opinion. The advantages of gamification also include the possibility of receiving regular feedback from the teacher and can be used in the distance learning process (Milosz & Montusiewicz, 2018). The introduction of the gamification principles into education during wartime allows for better assimilation of information in connection with game presentation. This approach enables

виконання домашніх завдань, перевірки знань були використані програма EdApp и Google Форма. Для вчителів найбільше значення має динамічність, оскільки сприяє участі всіх учнів і впливає на розвиток самостійності, мислення, творчих навиків. Під час дослідження виявлено, що учні 2-4 класів, які використовували в навчанні процеси гейміфікації, показали більш високу ефективність рівня знань. Встановлено, що серед школярів пам'ять і комунікабельність були розвинена в найбільшій степені. Практичне значення роботи полягає у можливості трансформації учбового процесу в результаті використання запропонованих інтерактивних програм. Перспективи дослідження можуть бути пов'язані з порівнянням ефективності використання прийомів гейміфікації серед учнів початкової і середньої школи.

**Keywords:** гейміфікація, початкова школа, груповий процес, ігровий формат, мотивація учнів, воєнний стан.

uninterrupted access to educational materials stored in the online space for students of the corresponding grade (Kanaki et al., 2022). The term "gamification" was introduced in 2022 by N. Pelling, but it was mentioned as early as 1896 with the release of Sperry & Hutchinson brands (Panyajamorn et al., 2018). The spread of gamification in Ukraine became possible thanks to O. Zaporozhets and D. Elkonin (Lovianova et al., 2020). The researchers found that it is the game that contributes to the psychological and mental development of the child, which can be used in the educational process.

The introduction of the gamification process in education contributes to increasing the level of students' knowledge, and developing skills that will make it possible to resolve different tasks. The introduction of the Wuzzit Trouble game into the learning process can be an example of gamification. According to the rules of the game, the learning process consists in the transition of students to different levels after completing mathematical assignments (Yang et al., 2022). The computer game Wuzzit Trouble provides for freeing the person from the cage by solving problems in order to motivate students more. The LMS Web application also promotes learning through gamification (Luo & Yu, 2022). Tovuti LMS is used to develop lessons and edit existing ones, which enables to display information using a virtual classroom. The programme provides for

the making lists of the most successful students. The application of the Loquiz online platform facilitates the development of games for learning and interaction between students (Oliveira et al., 2023). The application Can't Wait to Learn was developed with the assistance of the Ministry of Education and Science of Ukraine, which contributes to the education of elementary schoolers (Smrynova-Trybulska et al., 2017). According to the relationship, the learning process takes place by watching video lessons using game approaches to learning the material.

The issue of the introduction of gamification for learning during wartime in Ukraine is superficially covered in the academic literature. The aim of the article is to analyse the effectiveness of including gamification in the learning process when studying educational branches of primary school under martial law.

The research objectives are the following:

- identify the peculiarities of teachers' use of gamification in the educational process before the research, taking into account basic and additional assignments;
- develop approaches to the introduction of gamification into the learning process of primary schoolers, taking into account the combination of game format and innovative technologies;
- determine the significance of aspects of gamification that were taken into account in the educational process for students and teachers;
- determine the quality of the acquired knowledge of primary school students with the help of the efficiency ratio, taking into account the skills that have been developed.

### Literature review

The introduction of game technologies in the educational process affects the development of students' thinking, which was tested among 32 students and 4 teachers. Game technologies make it possible to eliminate the mechanical memorization of educational information, and to initiate the study of the material in an easy way. Game technologies contribute to the development of multi-functionality, student motivation, logical thinking, and also influence the development of independence. The game format of learning increases the efficiency of learning complex assignments as a result of the introduced innovations (Elmira et al., 2022a). Online platforms (Proprofs.com) facilitate the study of terminology by introducing creative

elements and a game format. The effectiveness of learning is related to the completion of various assignments that are available in online. Gamification is aimed at the assimilation of knowledge as a result of the use of motivating elements (badges, incentive prizes, excursions, etc.). The use of various quests also affects the motivation and development of students (Mirzoyeva, 2022). The use of gamification processes in the development of reading skills in primary school improves the organization of learning during the COVID-19 pandemic. Gamification makes it possible to provide a cross-learning process, which is aimed at the interaction of students and teachers with each other. Gamification contributes to the acquisition of technical and analytical skills as a result of ensuring the dynamism of learning. Learning was built on discussing the material that the students read, as well as presenting their own interpretation of the text (Calderón Arévalo et al., 2022).

EasyLogic3D enables integrating gamification in 3D format into the learning process. This programme facilitates the adaptation of primary schoolers to learning as a result of the use of a game scenario that attracts their attention. This approach promotes interaction between players, which affects the independence of studying the material. Games contribute to activation of brain activity, provision of individual and emotional connection (Ríos Félix et al., 2020). The main approach to teaching with Scratch was aimed at ensuring the sequence of learning. Scratch helps to present difficult material through a game using media technology. Audio and video materials contributed to text processing and influenced the provision of visualization in education. It is important to take into account that the game is adapted to the educational materials and to the age of schoolchildren (Prykhodchenko et al., 2020). Gamification affects the level of motivation of primary schoolers during physical education lessons. The Exergames application enables using digital games as a result of repeating movements. The application contributes to the concentration of students' attention in the specified period of time. Cognitive motivation affects students' interest in attending classes (Quintas-Hijós et al., 2020).

Gamification is an alternative to the traditional learning process, as it provides the study of theoretical material in an unusual format that is in line with the current stage of development. Gamification helps to overcome obstacles in the form of a game and to memorize material based on visualization. It also affects the development

of students' individuality, interaction with other students, and the absence of obstacles to expressing one's own opinion (Martínez-Hita & Miralles-Martínez, 2020). The WCRAS web-based system facilitates reading and annotating the material read, which increases the effectiveness of understanding the information read. Involvement of 55 students in the experiment made it possible to identify the level of cooperation between students and effectiveness in understanding the read material. The results showed that there was no difference in efficiency between gamification and the traditional process. However, students who involved gamification in learning presented a larger number of annotations on the read material. The degree of immersion in the studied material was also greater as a result of ensuring interaction between students. The difference in results is related to the motivation of students in the experimental group (Chen et al., 2020). The history and culture for primary schoolers was taught based on the use of slides depicting various assignments. Completing the assignments enabled a transition to a different

level as a result of searching for answers on the Internet. The use of mobile technologies enhanced students' learning motivation (Li et al., 2019).

The analysis of studies revealed the advantages of gamification, which affect students' motivation. However, the analysed works do not cover the approaches to the step-by-step study of the material, only elements that can provide training (online programmes, applications) are presented.

## Methods

### Research Design

The first stage of the research was based on interaction with teachers, which involved obtaining information about their understanding of the gamification process. A questionnaire survey was conducted among teachers through this method in order to find whether they used non-standard approaches earlier in the educational process (Table 1).

**Table 1.**  
*Peculiarities of the teachers' use of gamification in the educational process (before the research)*

Answer options	Answers of the respondents
Yes, gamification processes are used in the research	
Partially used	
No, they are not used	

The questionnaire survey was conducted through the use of e-mail, which made it possible to receive data directly from the respondents. E-mails of teachers were previously registered by the authors, which precluded obtaining unreliable results. According to the questionnaire, teachers were given 8 hours to present their answers. The obtained data were presented using percentages in the Results section.

The second stage of the research involved the development of approaches to the transformation of the educational process using gamification. For this purpose, the authors analysed various game approaches that can be used in the learning process. During the analysis of game approaches, the authors took into account the possibility of their adaptation to the education of junior schoolchildren, the possibility of using them in different subjects. The ability to use the programmes for a group of students, ease of use were also important. The development of learning approaches included the search for correct modern interactive programmes that

enable the inclusion of educational material in accordance with state recommendations.

At the second stage of the research, it was also planned to find out which of the aspects of gamification are most important for the educational process. The authors identified four aspects (dynamism, mechanics, aesthetics, social interaction) as a result of the literature analysis (Luo & Yu, 2022; Martínez-Hita & Miralles-Martínez, 2020; Oliveira et al., 2023; Prykhodchenko et al., 2020). The significance of gamification aspects was revealed after 4 months of training (September - December 2022). Data from the respondents were obtained through a questionnaire survey, which were used to calculate the significance coefficient.

The third stage of the research consisted in identifying the effectiveness of the developed educational approaches, which provided for the application of gamification principles. First of all, the effectiveness of education of primary schoolers was revealed. The effectiveness of learning the material was checked as a result of

taking into account the level of acquired knowledge, the ability of pupils to cooperate in a group, and their activity in classes. The obtained parameters were correlated with the total permissible number of points. The efficiency level was calculated according to the efficiency ratio. The results of the study present percentage data that reflect the number of students who received a certain level of knowledge (high, medium, low). The results were presented for students of two groups, which enabled evaluating the effectiveness of the developed approaches to learning. Group 1 pupils were taught according to the approaches developed by the authors, which included gamification approaches. Group 2 pupils studied according to the traditional system, which provided for the presentation of methodical materials in the conventional form. The pupils of two groups used Zoom online platform in order to ensure uninterrupted education during wartime. The online platform facilitated the interaction between students and teachers remotely. The obtained results were compared among different groups of pupils through calculations of the Spearman's rank correlation coefficient.

The third stage of the research also provided for identifying the skills they developed during the learning process in Group 1 pupils. The percentage ratio of pupils was presented using the results provided by the teachers. Emphasis in the study was placed on the skills of independence, sociability, creative thinking, memory, as gamification is primarily related to them.

### Sampling

The study involved 180 students, who were divided into two groups. Group 1 (92 pupils) studied with the use of the approaches developed by the authors, Group 2 (88 pupils) – using the traditional system. The criteria for the selection of pupils was their study in the junior grades of a school in Chernivtsi. The authors planned to involve 250 pupils in the study, but 60 of them were excluded. First-grade pupils were excluded from the study, as their curriculum requires more teacher supervision. The research programme provided for the involvement of gamification in the following educational fields: language and literature (literary reading), natural science, social and health care, mathematics, art).

### Methods

The first stage of the research involved the use of the questionnaire survey. The advantages of this

method are the possibility of its use not only offline, but also online. The survey of primary schoolers was ensured as a result of interaction with parents, which excludes violations of ethical norms (Committee on Publication Ethics, 2021). The questionnaire form is presented in Table 1.

The second stage of the research involved the use of a well-known method of analysis, which included the analysis of game approaches and existing computer programmes. The method of analysis was applied to identify interactive technologies that will contribute to the provision of education using the gamification principles. The implementation of approaches to learning became possible due to the availability of the classrooms, as well as access to the Internet and online programmes. The following technologies were used in learning: Zoom, Can't Wait to Learn, EdApp, Google Forms. Using well-known methods, the authors came to the conclusion that these programmes will ensure an uninterrupted learning process. The presented programmes will also motivate students to study. Zoom provides uninterrupted distance communication between students and the teacher, as required. The programme Can't Wait to Learn ensures an uninterrupted learning process in accordance with state requirements. The application provides for the development of educational materials, performance of game tasks. EdApp programme helps to ensure the study of the main material, which was presented in a game format (Find the Word, Yes or No). The EdApp programme also facilitated the study of basic academic terms. The use of Google Forms made it possible to verify knowledge with the help of computer tests, as well as passing different levels.

The second stage of research also provided for the calculation of the significance ratio, which was developed by the authors of the article (Formula 1):

$$R_{sign} = \frac{\sum(N_c + N_{a(i)})}{N_i} \quad (1)$$

$N_c$  – conditional score for the need to use the gamification aspect in education (5 – the maximum conditional score);

$N_{a(i)}$  – conditional assessment of the effectiveness of the selected aspect of gamification (5 – the maximum conditional assessment)

$N_{\pi}$  – the total number of indicators.

The calculation included experimental survey data. The calculation was carried out using the data received from pupils and teachers. The gradation enabled identifying discrepancies between the answers, which will contribute to improving the educational process in further research.

The third stage of the research involved mathematical methods of analysis, which were used to calculate the effectiveness of students' knowledge. The effectiveness of knowledge was tested among two groups of students, with further comparison of the results.

The efficiency level was obtained as a result of calculating the efficiency ratio according to the formula 2 developed by the authors:

$$R_{ef} = \frac{G_s + G_h}{S_m} \times R_a, \quad (2)$$

$G_s$  – average grades for the study period;  
 $G_h$  – average grades for doing homework;  
 $R_a$  – in-class activity coefficient (1 - maximum value);  
 $S_m$  – maximum allowable total score.

If the calculation of the efficiency ratio was within the limits of:

- from 1.7 to 2.0 – pupils had a high level of performance;
- from 1.3 to 1.69 – pupils had an average level of performance;
- below 1.29 - pupils had a low level of performance.

The distribution of performance levels differed from established school grades. A high level of

knowledge was obtained as a result of making 2 minor mistakes, as well as active participation in group work. Pupils who made from 2 to 5 mistakes were assigned medium level of knowledge. Pupils who made more than 4 mistakes, didn't perform homework and didn't actively participated in classes had a low level of knowledge.

The results of Group 1 and Group 2 pupils were compared by calculating the Spearman's rank correlation coefficient (Luo & Yu, 2022) (Formula 3).

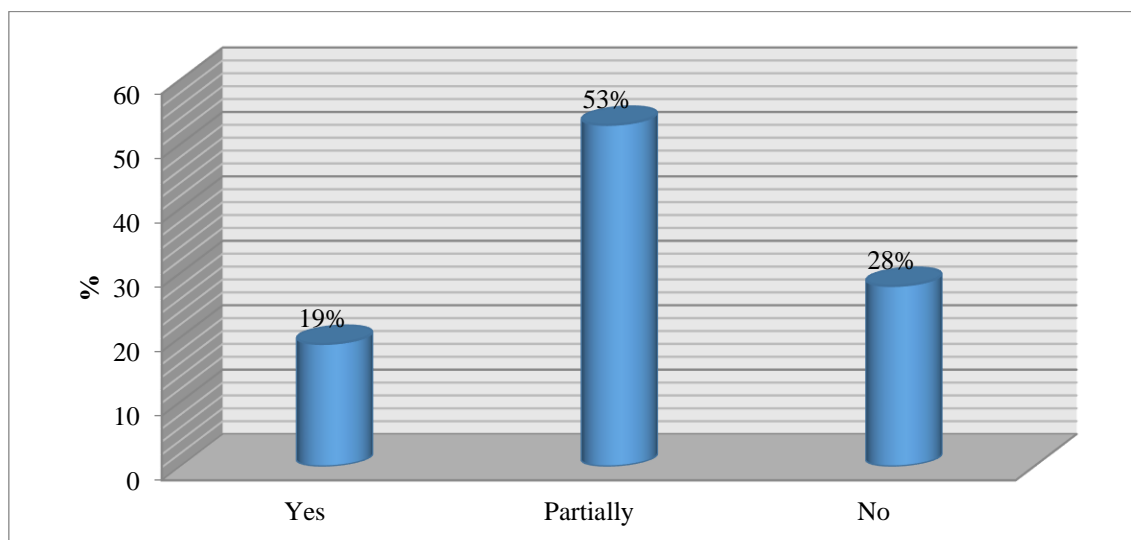
$$r_s = 1 - \frac{6 \sum_i d^2}{N(N^2 - 1)}, \quad (3)$$

$N$  – a quantitative indicator that shows the number of points scored;  
 $d$  – a ranked tabular value.

Values are correlated if the Spearman's rank correlation coefficient does not exceed 1.

## Results

In order to understand the specifics of the approach to the education of primary schoolers, the proportion of teachers who previously used gamification processes was identified. The data are necessary because they indicate the creative development and motivation of schoolchildren, which differs from the traditional approach to learning. The basic idea will contribute to the further development of approaches to the introduction of gamification into the learning process. Data from teachers were obtained as a result of a preliminary questionnaire survey (Figure 1).

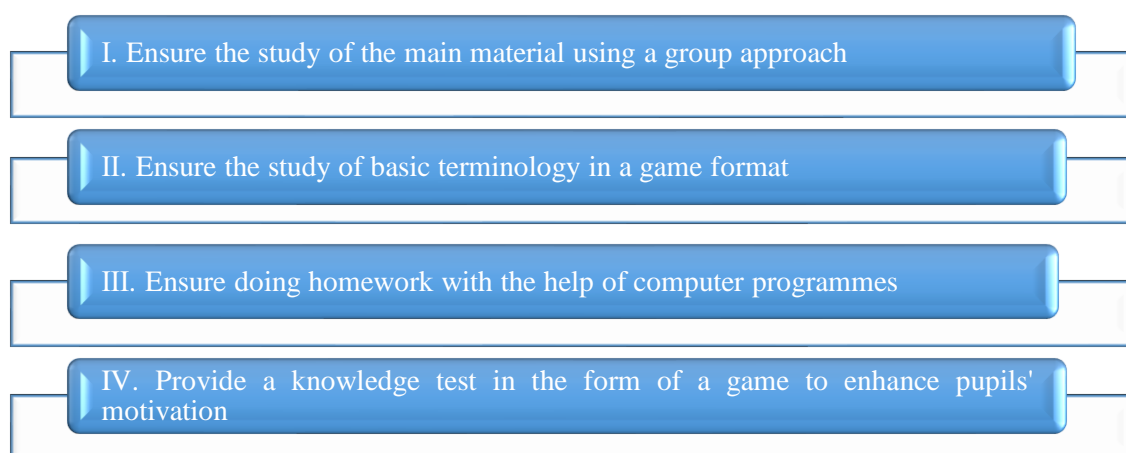


**Figure 1.** Peculiarities of teachers' use of gamification in the educational process before the research.

The results of the survey showed that more than half of the teachers who participated in the study partially used gamification techniques in the educational process. Features of the use were related to the study of a separate topic or during preparation for open lessons. For this purpose, the teachers used computer programmes that provided a game format for the answers. The teachers who partially used gamification approaches taught certain topics in a game format. The process involved completing assignments to advance to the next level. “No” answers ranked second according to the results of the questionnaire survey, because only traditional approaches were used in learning. Traditional approaches were based on the use of teaching materials that did not provide for the game format of acquiring knowledge. It was

established with the help of a questionnaire that only a part of teachers regularly uses gamification techniques in education, which affects the level of pupils’ motivation.

Based on the result of the obtained survey data, the authors came to the conclusion about the need to apply a serious approach to the development of gamification approaches in education. When applying gamification approaches, not only the level of teachers’ skills, the age of schoolchildren, but also the possibility of using them offline and online were taken into account. This approach is necessary because learning during wartime is blended and requires the most coordinated system. Such a system will allow conducting regular classes that do not depend on individual conditions (Figure 2).



**Figure 2.** Approaches to the introduction of gamification into the educational process in the study of educational branches of primary school

I. The authors came to the conclusion that a group learning process should be introduced for greater motivation of students and better assimilation of knowledge. For this purpose, schoolchildren were grouped by 4 people, which provided for the fulfilment of the assigned tasks. The learning process was organized in such a way that teachers explained the main topic of the lesson. Next, the schoolchildren were given the assignment of revealing the main aspects of the presented material at their own discretion. The mobile application Can’t Wait to Learn was used to ensure the gamification of learning, which made it possible to follow the educational programme approved at the state level. The study of a separate paragraph in the textbook involved its submission by schoolchildren in the format that they chose (retelling, use of their own illustrations, etc.). Then, among all groups of pupils in the class, it was found out

which of them studied the material in detail and was able to present it in an understandable format. The process included not only the determination of the group that most accurately learned the educational material, but also the receipt of virtual awards. The group of pupils who collected the most awards received an incentive prize — a visit to the museum. Aesthetic aspects were also taken into account during studies, which provided for a coherent educational process, as well as the emotionality of schoolchildren’s participation. The study of the main material also took place as a result of the use of the online application EdApp, which facilitates the conduct of classes offline and online. The authors used EdApp to develop templates for learning, which enabled teaching materials to be presented in a game format. Quizzes and templates were

- developed For this purpose, which provided the games Find the Word, Yes or No.
- II. The second approach, which was used in the training, was to ensure the study of basic terminology in a game format. For this purpose, teachers should have used the description of a separate term in accessible words, which would allow making associations. An associative series enables students to use creative thinking, which helps to memorize information. The groups of pupils were expected to display the description of the term with possible adjustments. The pupils learned of terminology during the game, where the schoolchildren were in the tower. They way out of the tower was possible as a result of correct answers to the questions. Correct answers to 5 questions gave the right to enter a new level. Studying terminology in this format enables pupils to learn the material, as terms are the basis for understanding the subject. The game format of studying terminology was conducted in the classroom with the help of questions posed by teachers, as well as through using the EdApp programme. Memorizing simple terms in the future helps to learn more complex ones. In the learning process, terms should be understood, not memorized with 100% accuracy according to teaching materials.
- III. The approach in the education of primary schoolers was to ensure the completion of homework with the help of computer programmes. EdApp was used to implement the approach, which enabled teachers to create a homework plan. The assignments included studying the material and performing step-by-step actions in a game format. Answers to quiz questions enabled pupils to focus on the subject and ensure its gradual study. The homework was completed when every subsequent level was passed. The lack of knowledge at one of the levels did not allow students to go to the next one, which affected the percentage of homework completion. Preparing homework in a game format gave pupils the opportunity to find ways to overcome difficulties and acquire the necessary level of knowledge. Using the EdApp programme enables obtaining a grade for the homework immediately after completing it. The teachers checked the correctness of solving individual examples and problems.
- IV. A knowledge test in the form of a game helps to make pupils less nervous than during regular tests. The knowledge test included short answers using developed computer tests, as well as detailed answers to questions. Test items were created using Google Forms. The pupils who completed the assignments most correctly were awarded virtual prizes, the largest number of which gave the right to visit the educational exhibition at the end of the semester. A ranking of the pupils of the class was also created based on the results of the acquired knowledge, which contributed to the development of competition and pupils' motivation. The pupils' motivation was ensured through the use of certificates, which indicated a high level of acquired knowledge.
- After 4 months of learning with the use of developed approaches, the teachers and pupils identified the aspects of gamification that were developed with the highest quality. Dynamism, mechanicalness, aesthetics and social interaction were identified among the gamification aspects. Data from respondents were collected using a questionnaire, which subsequently allowed for the calculation of the significance ratio using Formula 1. The results are presented in Table 2.

**Table 2.**

*Identification of gamification aspects that were most clearly taken into account in the educational process*

Gamification aspect	According to pupils	According to the teachers
<b>Dynamism</b>	1.75	2.5
<b>Mechanicalness</b>	2.45	1.8
<b>Aesthetics</b>	1.6	1.55
<b>Social interaction</b>	2.15	2.2

It was established based on the calculations that the “mechanical” aspect was of the greatest importance for the pupils. The results are related to the fact that mechanicalness is interconnected with the received awards, the use of specialized

programmes (Can't Wait to Learn, EdApp, Google Forms). Mechanicalness was of the greatest importance, as it was aimed at motivating students to achieve the highest results. Teachers believe that mechanicalness



should be ranked third, as the emphasis should be on the acquisition of knowledge. According to the teachers' answers, dynamism was developed most clearly, because it involved the concentration of pupils' focus on a separate task. Social interaction is also important for learning, as it promotes the development of pupils' socialization, enables them not to be afraid to express their opinion. Pupils ranked dynamism third, as it requires a lot of concentration and independence during learning. Both teachers and students ranked aesthetics last, as it relates to creating an overall learning experience and emotional commitment. But it was first necessary to learn approaches to using modern programmes, which affected the overall impression. Aesthetics during learning was only

partially taken into account, which requires its further development.

The level of pupils' knowledge was identified during the research. For this purpose, the knowledge of pupils who studied with the use of gamification techniques (Group 1) was compared. The results were also compared with students who studied according to the traditional education system (Group 2). During the comparison, the level of acquired knowledge, the ability to cooperate in a team, and pupils' activity in groups were taken into account. The efficiency was calculated as a result of applying the efficiency ratio calculations according to Formula 2. The results are presented in Table 3.

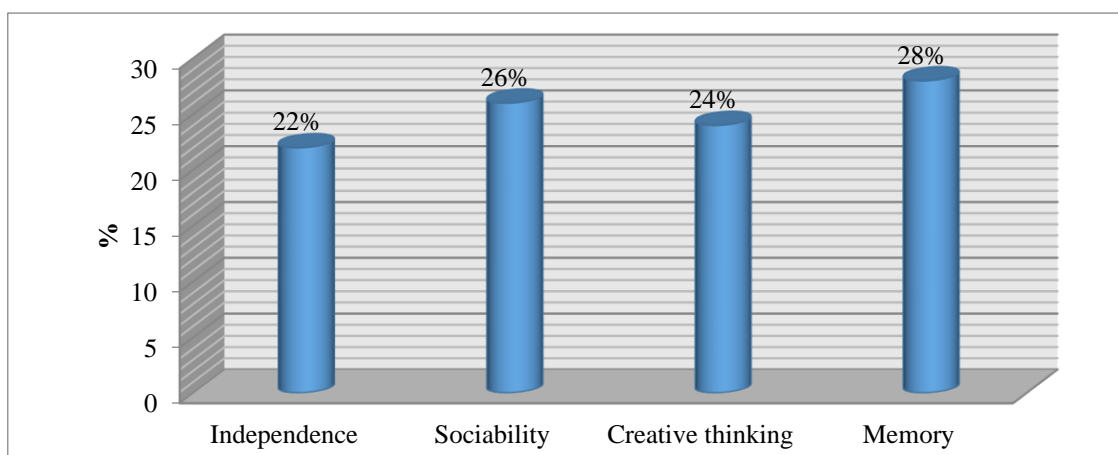
**Table 3.**  
*Efficiency of acquired knowledge of primary schoolers*

Efficiency of the class	Group 1		Group 2		Spearman's rank correlation coefficient
	Calculation of the efficiency ratio	Percentage ratio of pupils	Calculation of the efficiency ratio	Percentage ratio of pupils	
	<b>Grade 2</b>				
<b>High</b>	1.78	68%	1.73	41%	0.834
<b>Medium</b>	1.32	32%	1.30	48%	0.718
<b>Low</b>	-	-	0.92	7%	-
	<b>Grade 3</b>				
<b>High</b>	1.80	72%	1.72	29%	1.261
<b>Medium</b>	1.40	26%	1.36	59%	1.037
<b>Low</b>	0.91	2%	0.90	12%	0.983
	<b>Grade 4</b>				
<b>High</b>	1.75	52%	1.73	38%	0.693
<b>Medium</b>	1.38	47%	1.28	54%	0.367
<b>Low</b>	0.93	1%	0.92	8%	0.951

Comparison the performance of the pupils of both groups found that the pupils of Group 1 showed higher results. Their effectiveness is related to the use of gamification techniques, which enhance pupils' motivation. Pupils of Group 1 in Grade 3 obtained the highest results, because they completed the assignments responsibly. The high efficiency of pupils of Group 1 is associated with the development of independence, receiving constant feedback from the teacher. The learning process was aimed at developing confidence, sociability, and non-standard thinking. Pupils of Group 2, who studied according to the traditional system, had a lower knowledge efficiency. This is explained by the fact that learning required concentration when learning the subject. Repetition of the

material was possible only as a result of using textbooks. The pupils of Group 1 could reproduce the lesson at a convenient time as a result of using the materials of Can't Wait to Learn and EdApp. They also had the opportunity to complete assignments and check the level of knowledge they had acquired. The pupils of Group 2 also had low efficiency indicators, which is explained by the lack of regular feedback. A comparison of the obtained results showed that the indicators of third-graders had the largest values that do not correlate.

The final stage of the research provided for identifying the skills that the pupils of Group 1 developed during training. The results are presented in percentages in Figure 3.



**Figure 3.** Skills acquired by pupils of Group 1, who studied with the use of gamification

The distribution of acquired skills by schoolchildren during their studies showed that the most pupils developed memory. The process is connected with regular memorization of the material, completion of assignments to consolidate it, discussion between pupils and teachers. Sociability ranks second in terms of acquired skills, which was developed as a result of grouping pupils by 4 people. This approach enabled all schoolchildren to continue education. This was reflected in defending one's opinion, showing initiative and lack of fear in presenting information in front of the class and the teacher. Pupils' creative thinking ranked third, which is connected with the use of computer programmes for studying terms and analysing material. Independence was developed among a smaller number of students, since elementary schoolers need correction of their actions by teachers.

### Discussion

Digital technologies contribute to the implementation of the gamification process in education, thereby contributing to the creation or use of existing computer games for education. Game dynamics help encourage students to learn new material, as it is built on mystery that can be revealed after solving tasks. The mystery lies in the form of presentation of the material, obtaining the final result, which affects the overall ranking, the final reward format (Elmira et al., 2022b). The use of the gamification process in education with the help of board games promotes the study of the English language. Learning efficiency is achieved as a result of reducing students' anxiety. A double hierarchical structure of the board game was developed in order to ensure an uninterrupted learning process, which involved game learning and the use of board cards. Board cards reflected

the main material and promoted the visual perception of new words with the help of images. Group discussion and joint reading made it possible to use the learned words, which contributed to the effectiveness of their memorization. This approach made it possible to understand the read material and develop memory (Li et al., 2022). A personalized learning process can be achieved as a result of using the Smart-Learning Partner (SLP) platform, which includes the basics of artificial intelligence. The availability of various assessment tools, high-quality lectures, and video materials contributes to the improvement of learning. Social interaction between students as a result of using the Smart-Learning Partner platform enables expanding knowledge in the process of exchange between students (Niu et al., 2022). In comparison with the presented works, several information technologies were used in this study to support the educational process. The technologies used (Can't Wait to Learn, EdApp, Google Forms) promote gamification in education among primary schoolers.

The use of the WCRAS virtual system in the educational process improves the reading quality of primary schoolers. WCRAS programme made it possible to carry out a more detailed analysis of the text and note down the information. The results show that the reading competence of students increases as a result of improving the text comprehension system (Tsai et al., 2020). The use of gamification methods can also promote not only the acquisition of a high-level knowledge, but also provide a positive emotional state. Emotions are important for providing intellectual activity, which can be associated with stress, frustration. The game format reduces negative factors in the educational process, as it contributes to a lower workload, promotes visual

perception of information in an understandable way (Zatarain Cabada et al., 2020). Information technologies in combination with gamification affect the transformation and popularization of education. Completion of practical assignments promotes the development of creativity and thinking as a result of conducting a parallel between the educational process and the game format. Gamification is interconnected with feedback, which makes it possible to progress through game levels until the minimum number of mistakes is made. The games developed for learning are built on a comprehensive approach, which facilitates the learning of the necessary material in a simpler format (Wei & Yang, 2023). The relationship between personalized gamification learning approach, gained experience and student motivation was not found. The results of the study showed that only regular classes help to achieve a high level of knowledge (Oliveira et al., 2022). This study established not only the effectiveness of the information technologies used, but also the importance of gamification aspects.

The effectiveness of learning can be increased as a result of conducting open online lessons and using the gamification principles. The effectiveness of learning is related to the possibility of obtaining knowledge as a result of access to educational materials. The use of an educational game contributes to the familiarization of schoolchildren with new material and its consolidation as a result of orientation to graphic materials (Panyajamorn et al., 2022).

The analysis of literature showed that the majority of studies are aimed at applying the gamification principles in distance education. It was established that gamification affects the improvement of the emotional state of students, which affects the level of acquired knowledge. In this study, approaches to ensuring the educational process using gamification of primary schoolers under martial law were developed. The gamification aspects (dynamic, mechanical, aesthetic, social interaction) that have the greatest impact on students and teachers have also been identified. The quality of the acquired knowledge in the work was measured using the efficiency ratio. The obtained results correspond to the hypothesis of the study and correspond to the aim of the study, as the work presented mechanisms for organizing the education of primary schoolers. The approaches can be adapted in the course of the learning process.

## Conclusions

The relevance of the research was confirmed as a result of achievement of the aim, as the work presented approaches to providing education to primary schoolers using the gamification principles and revealed their effectiveness. Gamification processes contribute to the motivation of schoolchildren to study subjects and are aimed at the development of their socialization thanks to the ability to express their own opinion. Emphasis on gamification contributes to the assimilation of educational materials in a more understandable format.

The authors of this study established that 28% of teachers have not previously used gamification techniques in education, 53% have used them partially. The obtained data made it possible to assess the level of preparation of teachers for the transformation of the educational process using gamification techniques. As a result, the authors developed the following approaches to the transformation of primary schoolers' learning:

- emphasis on studying the main material;
- study of basic terminology in game format;
- doing homework using computer programmes;
- providing a knowledge test in the form of a game to motivate students.

The implementation of the educational process became possible as a result of the use of online programmes such as EdApp, Can't Wait to Learn, creation of tests using Google Forms. Pupils were divided into groups of 4 people for the convenience of conducting lessons.

The research established that mechanics (2.45) and social interaction (2.15) are of greatest importance for pupils in the learning process. The reason is that these gamification aspects contribute to receiving incentives and are directed to work in a team. Teachers believe that the most important aspects are dynamism (2.5) and social interaction (2.2). This is explained by the fact that pupils develop thinking, independence and sociability during their studies.

A comparison of two groups of pupils revealed that students of Group 1 (gamification was used during learning) showed greater performance. The largest number of high results were obtained by third-graders (72%), which is related to the responsibility of completion and accuracy of assignments. The highest results in Group 2, which studied according to the traditional

system, were obtained by second-graders. It was found that 28% of schoolchildren, developed memory, 26% developed communication skills, 24% developed creative thinking, and 22% developed independence.

The practical significance of the work is the possibility of transformation of the educational process as a result of the introduction of gamification for learning material and terminology, testing knowledge. The obtained research results can be used in offline and online education, as well as when conducting optional classes. Prospects for future research may be related to the use of various digital gamification technologies in education, and comparison of their effectiveness among schoolchildren.

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