



PAPER

## NEURODIDACTIC FOUNDATIONS OF USING GAMIFICATION ELEMENTS IN ORGANIZING LESSON ACTIVITIES

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### Abstract

This article analyzes the neurodidactic foundations of using gamification elements in organizing classroom activities. The study highlights the importance of considering students' cognitive, emotional, and motivational characteristics in the educational process. It also provides a scientific explanation of the neurophysiological mechanisms of gamification, particularly its effects on the dopamine system, emotional engagement, and the formation of active memory. The research results demonstrate that applying gamification elements within a neurodidactic approach is a significant factor in improving the effectiveness of education. At the same time, the importance of maintaining pedagogical balance in the use of gamification is emphasized.

**Key words:** neurodidactics, gamification, active learning, motivation, emotional impact, dopamine system, cognitive processes, educational technologies, learning process, innovative approach.

### INTRODUCTION

The content of learning activities organized in line with modern educational trends increasingly necessitates the large-scale integration of digital components alongside traditional instructional elements. Conventional teaching methods are no longer sufficient to meet the needs of 21st-century learners; they often fail to ensure full student engagement, which ultimately leads to a decline in knowledge acquisition levels. Therefore, in

contemporary pedagogy, particular importance is attached to approaches that activate students' cognitive activity and enhance their motivation.

In recent years, a neuroscience-based approach—neurodidactics—has been introduced into the educational process, making it possible to organize learning in alignment with the functioning of the human brain. This approach contributes to a deeper understanding of the mechanisms of attention, effective information processing, and long-term memory retention. In particular, the influence

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of emotional state, interest, and motivation on the learning process is considered one of the key aspects of neurodidactics. In this regard, the German neurobiologist Manfred Spitzer stated that “emotion, motivation, and interest directly govern the learning process” [1].

In addition, the gamification method, which has been widely applied in education in recent years, is regarded as an important tool for effectively organizing the learning process. By incorporating game elements into education, students’ interest increases, they are encouraged to participate actively, and the learning process becomes more interactive. Points, levels, rewards, and ranking systems foster motivation and a competitive environment, thereby enhancing educational effectiveness. The Decree of the President of the Republic of Uzbekistan dated October 8, 2019 (No. PF-5847) “On approving the Concept for the Development of the Higher Education System of the Republic of Uzbekistan until 2030” [2] also outlines specific measures for introducing digital technologies and modern methods into the educational process, highlighting the necessity of using gamification elements in pedagogical practice.

This article analyzes the theoretical and practical aspects of using gamification elements in organizing classroom activities based on a neurodidactic approach through the integration of these two modern methodologies. It also examines the impact of this approach on students’ learning outcomes, motivation, and engagement.

## LITERATURE REVIEW AND METHODS

In recent years, numerous scientific studies have been conducted on integrating gamification and neurodidactic approaches into the educational process. Organizing education based on a neurodidactic approach has become one of the key directions of modern pedagogy. This approach is grounded in the functioning mechanisms of the human brain, particularly the interrelationship between cognitive processes, emotions, and motivation. Research shows that learning is not merely the acquisition of knowledge but is closely linked to emotional state and motivation, which determine the effectiveness of learning activities [3]. Gamification is considered one of the most

effective tools for implementing these neurodidactic principles in practice. By integrating game elements into the educational process, it increases student engagement, enhances concentration, and supports knowledge retention. Scientific studies indicate that gamification strengthens students’ cognitive activity, increases emotional involvement, and promotes the development of intrinsic motivation.

Professor Karl Kapp of Bloomsburg University (USA) defines gamification as “the use of game-based mechanics, aesthetics, and game thinking to engage people, motivate action, promote learning, and solve problems” [4]. Professor Scott Nicholson of Wilfrid Laurier University (Canada) emphasizes that “the most distinguishing feature of gamification compared to traditional approaches is the explicit use of competition as a motivational tool. This element of competition serves as a source of motivation” [5]. Academic researcher Maristela Petrovic-Dziedz from Athabasca University (Canada) notes that in education, the term “gamification” does not simply refer to playing games, but rather to “the application of game features and mechanics in non-game contexts” [6].

In other words, gamification is not about playing games, but about incorporating game elements into the learning process to make it more engaging and effective. Furthermore, research conducted by Petrovic-Dziedz demonstrates that gamified online tests enhance students’ retrieval practice, thereby positively influencing the formation of long-term memory. From a neurodidactic perspective, positive emotions generated through game elements contribute to better assimilation of learning material. Cognitive and emotional processes are interrelated and jointly improve learning effectiveness. Therefore, gamification should be viewed not only as a technological tool but also as a psychological-pedagogical mechanism [7].

In addition, gamification enables the individualization of learning, provides rapid feedback, and ensures active student participation. Studies show that when gamification elements are applied correctly and comprehensively, learning outcomes improve significantly. Several international scholars, including Pablo Alexander Munévar, Patrick Buckley, Elaine Doyle, and Carlos Vaz de Carvalho, have also conducted research on this topic in their scientific work.

A number of pedagogical researchers within the Uzbek academic context have also addressed the application of gamification elements in the educational process in their scientific works. For example, I.M. Axundjanov emphasized the positive impact of gamification, stating that “gamification helps to engage students and maintain their attention. By tracking their achievements, students develop self-regulation skills, while challenges and missions foster their creative thinking” [8]. In addition, researchers such as Z. Ortiqova, J. Suyumov, Y.S. Sidiqova, and G.U. Kholboyeva, along with several other scholars, have explored various aspects of this topic in their studies. However, the limited exploration of gamification specifically in connection with neurodidactics further enhances the theoretical and practical significance of the present research.

During the research process, extensive use was made of theoretical analysis and synthesis of literature related to the topic, including scientific articles by both international and Uzbek scholars, as well as methods such as comparison, systematization, pedagogical observation, and interviews.

## RESULTS

In 2024, the American psychotherapist Benjamin Fry used the BaZ model to assess students' knowledge in neuroanatomy. The results demonstrated that the use of gamification elements within a neurodidactic framework significantly increases lesson effectiveness [9]. It can be observed that in lessons where gamification elements (points, levels, rewards) are applied, students' interest and intrinsic motivation increase substantially. This finding once again confirms one of the core principles of neurodidactics—the interconnection between emotional and cognitive processes.

Contemporary studies also indicate that gamification improves students' motivation and their attitude toward learning. Furthermore, the enhancement of learning effectiveness through positive emotions can be considered an important outcome of the neurodidactic approach. This, in turn, contributes to the strengthening of students' long-term memory.

From a neurodidactic perspective, the essence of gamification lies in the use of game elements to

increase student engagement and improve learning efficiency. The primary focus is not on transforming the learning process into a “game,” but rather on activating students' cognitive and emotional processes.



Figure 1

From the infographic above, it can also be observed that although these elements may appear to be simple motivational tools on the surface, from a neurodidactic perspective they activate deep psychological and neurophysiological processes in the brain. In this regard, each element will be discussed separately with an emphasis on its neurodidactic foundations.

According to the neurodidactic approach, the most significant effect of gamification is related to the brain's reward system. When learners receive points, level up, or earn badges, the release of dopamine in the brain increases. This, in turn, enhances learners' motivation, encourages continued active engagement, and forms a sense of positive anticipation. Consequently, learners begin to engage in active learning with an internal motivation such as “I will win again” or “I will earn more points again.” This process represents a mechanism of strengthening intrinsic motivation through external reinforcement. Gamification also enriches the learning process emotionally. Learners do not only acquire knowledge but also directly experience emotions such as interest, competition, a sense of achievement, and self-assessment during the process. Neurodidactic research shows that knowledge associated with emotions is processed more quickly by the brain and is better retained in long-term memory. In particular, positive emotions (success, encouragement, achievement) significantly enhance learning effectiveness [10].

Gamification transforms learners from passive recipients into active participants. Missions, tasks, and step-by-step progression systems encourage learners to think continuously, make decisions, and solve problems. This process activates active memory, enables the reinforcement of knowledge through repetition, and, most importantly, provides opportunities to apply acquired experience in practice. As a result, knowledge is more deeply internalized by students, stored more effectively in long-term memory, and skills become easier to apply in real-life situations.

The ranking system (leaderboard) activates mechanisms of social comparison among learners. This, in turn, stimulates psychological processes such as:

- comparing one's abilities with others;
- striving to improve one's position;
- developing social motivation.

This activation fosters a sense of healthy competition within the educational environment. Learners are able to compare their academic performance at the group level and identify their weaknesses in relation to their peers. However, from a neurodidactic perspective, this mechanism must be applied with caution, as excessive competition may lead to stress, anxiety, and a decrease in motivation due to persistently low performance.

Based on the general conclusions drawn from the literature, game elements activate three main systems of brain activity:

- Reward system (dopamine) → motivation
- Emotional system → interest and engagement
- Cognitive system → memory and learning

Therefore, from a neurodidactic standpoint, gamification is not merely a teaching method but a modern pedagogical strategy aligned with the brain's natural learning mechanisms.

Through the infographic above, you can gain a clearer understanding of the neurodidactic foundations of the positive impact of gamification elements on the learning process.

## DISCUSSIONS

The analysis of the obtained results indicates that if learning outcomes improve positively through game-based elements, it becomes essential to identify which specific factors within this process exert such a significant influence. Naturally, this

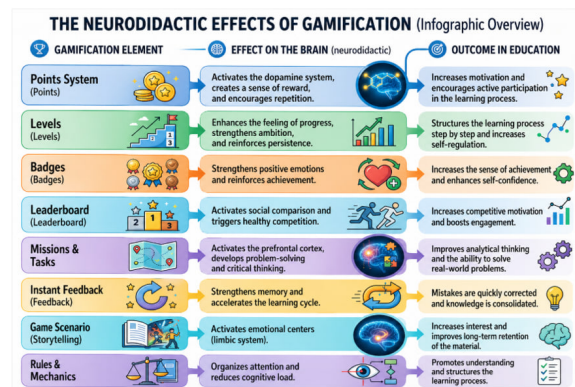


Figure 2

raises the question: does gamification possess a unique advantage, or can other forms of active learning produce similar outcomes as well?[9]

One of the key sources on this topic is Meyers and Jones, who compare active learning with passive learning and emphasize that active learning is not limited to listening but encompasses a wide range of activities [11]. Such activities place strong emphasis on the development of students' skills and their active engagement in the learning process. This framework includes group discussions, role-playing, flipped classrooms, cooperative teaching, and, of course, gamification.

One of the main distinctions between gamification and other forms of active learning is its emphasis on competition. The "winning" element becomes integrated into the learning process, which initially positions gamification as a potentially stronger motivational tool compared to other active learning approaches.

A review of numerous scientific studies reveals that most of them highlight the positive impact of gamification on the educational process. However, there are aspects of this approach that may lead to negative effects if not implemented appropriately. Scholars such as Armando Toda, Pedro H. Valle, and Seiji Isotani emphasize that gamification does not always yield positive outcomes and, when misapplied, may even harm the learning process. As they state, "Gamification is a powerful pedagogical tool, but if misused, it can reduce the quality of education" [12].

In our view as well, excessive reliance on reward-based motivation may lead students to develop a learning orientation driven primarily by rewards rather than a conscious engagement

with knowledge acquisition. Furthermore, the continuous use of gamification elements in pedagogical practice may, over time, reduce students' interest, eventually leading to fatigue or boredom with this approach.

It should also be noted that individual learner differences must be considered when applying game elements. Attention must be given to students who are less inclined toward competition, ensuring that they are not excluded from the learning process. As a preventive measure, it can be argued that educators should be sufficiently equipped with neurodidactic knowledge. Neurodidactics provides a deeper understanding of brain-based learning processes, individual cognitive reception patterns, and learner-specific characteristics.

Researchers such as Tim Jay, Paul Alexander Howard-Jones, and Alice Macon have proposed the hypothesis that integrating game elements into the learning process enhances learning outcomes. It was expected that increased student engagement and cognitive activation would manifest through heightened activity in the working memory network (WMN) and reduced activity in the default mode network (DMN).

Their study demonstrated that as learning conditions became increasingly gamified, activity in DMN regions decreased. At the same time, participants reported higher levels of interest, and learning outcomes were particularly improved in game-based conditions [13].

Overall, the use of game elements in the educational process can be understood as the creation of a learning environment that is optimally aligned with students' cognitive styles, thereby facilitating more effective knowledge acquisition. This approach has increasingly attracted the attention of researchers in recent years, which is not surprising given its recognition as an innovative direction in contemporary education.

It also imposes an additional responsibility on practicing educators, namely the requirement to integrate gamification elements with neurodidactic knowledge alongside their academic expertise in order to effectively organize teaching and learning processes in the 21st century. Such an integrated competence is considered essential for the full realization of the objectives set within the pedagogical process.

## CONCLUSION

In conclusion, it can be stated that the needs of learners in today's digitally integrated world can no longer be fully satisfied through traditional educational approaches alone. We consider systematic research to be the most appropriate solution to address this pressing issue. In this regard, we undertook this study as a further step in this direction, which may serve as a small but meaningful contribution to addressing existing challenges in the field. Modern educators must be prepared for the latest demands and be able to effectively apply these approaches in practice. In addition, acquiring knowledge of neurodidactics and developing a deep understanding of the field is considered essential across all aspects of educational activity [14].

This study analyzed the neurodidactic foundations of using gamification elements in the organization of instructional activities. The findings indicate that taking into account the cognitive, emotional, and motivational characteristics of the human brain is a crucial factor in enhancing educational effectiveness. From a neurodidactic perspective, gamification contributes to improving students' attention, strengthening memory, and increasing cognitive engagement. In particular, the stimulation of dopamine release through reward systems enhances students' interest in learning. Furthermore, elements such as active learning, immediate feedback, and step-by-step progression support the deep and stable acquisition of knowledge.

However, the study also found that improper or excessive use of gamification may lead to certain negative consequences. In particular, over-reliance on extrinsic motivation may reduce intrinsic motivation, while excessive competition may cause stress and a lack of confidence in some learners. Therefore, maintaining pedagogical balance in the application of gamification elements is of critical importance.

In future research, it is advisable to further investigate the integration of gamification with individualized learning trajectories, its incorporation with digital technologies, and its adaptation for different age groups. In these studies, reliance on neurodidactic knowledge will play a particularly important role.

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