

НАУКОВО-ТЕХНІЧНА КОНФЕРЕНЦІЯ МОЛОДИХ ВЧЕНИХ

Актуальні проблеми інформаційних технологій



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THE ROLE OF COMPETITION AS A GAMIFICATION ELEMENT IN ENHANCING LEARNING MOTIVATION AMONG COMPUTER SCIENCE STUDENTS

Gamification has become an increasingly relevant approach in higher education, particularly in disciplines that require continuous skill development and problem-solving, such as computer science. Among the various game elements integrated into the learning process, *competition* plays a significant role in stimulating motivation, engagement, and perseverance. In gamification theory, competition is defined as a mechanic that encourages individuals to outperform others in pursuit of a goal, often measured through points, rankings, or achievements (Werbach & Hunter, 2012). In the gaming world, competition drives players to reach higher levels, earn rewards, and outperform others.

For computer science students, who often possess a natural affinity for digital environments and logical problem-solving, **competitive gamification** can create a sense of purpose and excitement in learning. According to Self-Determination Theory (Deci & Ryan, 1985), competitive elements can fulfil the psychological need for competence, thereby enhancing intrinsic motivation. When students feel capable and challenged, they are more likely to engage deeply with learning tasks.

To determine the students' familiarity with gaming mechanics and their potential engagement level in gamified learning environments, a short survey was conducted among students majoring in Software Engineering and Computer Science at Igor Sikorsky Kyiv Polytechnic Institute, Taras Shevchenko National University of Kyiv, and Kyiv National University of Technologies and Design.

The survey involved 124 participants and was administered through a poll distributed via social media, specifically shared in student group chats **Fig. 1**. It contained a single multiple-choice question: "How much time per day do you usually spend playing video games?" Respondents could select one of the following options:

- I don't play at all (35 responses, 28%)
- Up to 2 hours (25 responses, 20%)
- 2–4 hours (27 responses, 22%)
- 3–5 hours (12 responses, 10%)
- More than 5 hours (25 responses, 20%)

These findings suggest that a significant portion of students are already

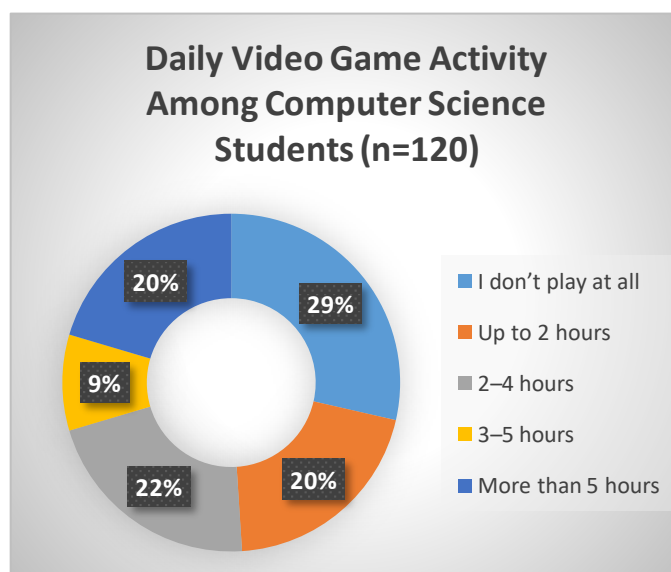


Figure 1. Distribution of daily time spent playing video games among computer science students (n = 120).

engaged with game-based environments, indicating a strong potential for implementing gamification strategies in software engineering education. Their familiarity with gaming mechanics can serve as a foundation for integrating gamified learning strategies that resonate with their existing habits and preferences.

These observations are consistent with findings in recent research. In a review of gamification in software engineering education, *competition* emerged as the most frequently applied element, followed by *cooperation* (Tonhão et al., 2023). Overall, a wide range of gamification elements has been employed across different software engineering knowledge areas, but competition appears particularly effective in motivating students and enhancing engagement. This aligns with the notion that competitive dynamics can foster a sense of achievement, mastery, and progress – key drivers of sustained motivation.

Competitive gamification can take multiple forms within software engineering education, ranging from coding challenges and hackathons (Oyetade et al., 2024) to leaderboard-based assignments and peer comparison systems (Korniienko et al., 2023). Such activities not only stimulate intrinsic motivation through achievement and mastery but also enhance teamwork, problem-solving, and time management skills.

Moreover, integrating competition in a structured and balanced way ensures that the focus remains on learning outcomes rather than solely on winning, fostering both individual growth and collaborative learning.

However, it is important to recognize that competition, while powerful, is not universally beneficial. Excessive emphasis on outperforming peers may lead to stress, anxiety, or reduced collaboration, especially among students who are less confident or new to programming. Therefore, integrating competition in a structured and balanced way is essential. When designed thoughtfully, competitive gamification can promote both individual growth and collaborative learning, ensuring that the focus remains on educational outcomes rather than solely on winning.

A practical example of balanced competition can be observed in the use of Quizlet Live, a collaborative classroom game where students compete in teams to match correct answers faster than their peers (Makhovych, 2024, p. 38). Unlike traditional individual competitions, this format encourages both rivalry and cooperation, as team members must communicate effectively to succeed. In computer science courses, such team-based competitions can be applied to reinforce terminology, programming concepts, or software development principles. This approach maintains the motivational benefits of competition while simultaneously fostering teamwork, communication, and collective problem-solving skills.

To maximize the benefits of competition in gamified learning environments, educators should consider combining it with other elements such as cooperation, feedback, and narrative. This hybrid approach can help accommodate diverse learner profiles and foster a more inclusive and motivating educational experience. This aligns with the idea that gamification should not be reduced to isolated mechanics, but rather implemented as a holistic system that fosters an engaging and goal-oriented learning environment (Арістова & Махович, 2023).

Competition, when thoughtfully integrated as a gamification element, can significantly enhance learning motivation and engagement among computer science students. Its alignment with students' familiarity with gaming environments makes it a powerful pedagogical tool in software engineering education. However, its success depends on careful design that balances challenge with support, individual achievement with collaboration, and motivation with well-being. Future research should further explore adaptive models of gamified competition that respond to diverse learner needs and evolving digital learning contexts.

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