

## "Smart PM city" game development for educational purposes

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### ABSTRACT

The article examines the peculiarities of using games in the educational process and analyzes the relevant literature. The main stages of the implementation of the board game "Smart PM city", developed at the department of project management of the Kyiv national university of civil engineering and architecture, are described. The game is aimed at developing cognitive, social skills and knowledge in the field of project management. Implementation includes defining educational goals, developing a game based on educational material, adapting it to the educational process, instructing participants and reflection after the game. The effectiveness of the game is evaluated through observation, testing and surveying of students, with subsequent adjustments.

*Keywords: gamification, curriculum, cognitive skills, project management, learning.*

### 1. INTRODUCTION

Today, entertainment such as board and computer games occupy an important place in the lives of both young and adult generations of people. And every year, the number of people who spend their free time playing video games is growing.

The usage of new teaching methods through educational materials has a positive effect on the level of training of both school pupils and students. Gamification builds a "bridge" for this, because the new young generation has been familiar with this since childhood. This paper will consider the possibility of integrating games into the educational process in project management speciality.

### 2. PURPOSE OF WORK

Describe the process of developing a game that will increase students' motivation, involvement and interest in learning using game elements. It helps improve learning, develop collaboration skills, solve problems, and increase productivity. Gamification makes the learning process more interactive, allowing students to experience achievement, progress and competitive spirit, which in turn improves their motivation and learning outcomes.

### 3. LITERATURE REVIEW

There are many articles related to the entertainment element implementation into the educational process, which serve to improve the understanding of the problems of this area. The study [1] examines the challenges of delivering e-learning programs in a blended mode, particularly in the context of technical and vocational education and training. The goal is to develop a gamified design to increase student motivation and engagement, which in turn will facilitate better acquisition of employability skills. The proposed model includes fifteen game dynamics, related mechanics, and components that are integrated into online courses through an open-source learning management system. However, such a system does not provide for the verification of already acquired knowledge in a game form.

In [2], the author summarizes the results of research on the impact of gamification on cognitive, motivational and behavioral learning outcomes. Gamification showed a small but significant effect on cognitive, motivational and behavioral outcomes.

Article [3] examines common misunderstandings about gamification, including criticism that it is a marketing gimmick. The authors challenge this simplification, emphasizing the existence of theoretical and empirical research in the field of gamification based on postpositivist epistemology. Gamification, unlike general game design, is more results-oriented and has a stronger foundation in the social sciences. The paper also describes the philosophical underpinnings of gamification, its relationship to games, and presents six key elements of gamification research through a causal model.

In [4], the authors present a panoramic research map, which contains a research map and keyword maps for each year of gamification research publication. The research panorama map provided a detailed overview of gamification research: areas covered, types of published work, gaps and most researched topics.

Research [5] studies the impact of gamification elements (scores, levels, leaderboards) on motivation, sense of competence, and performance in the task of image annotation. Although these elements did not significantly affect participants' competence or intrinsic motivation, they significantly increased the number of tasks completed. The results show that points, levels and leaderboards act as extrinsic incentives that are only effective for increasing quantitative performance, not for improving quality or intrinsic motivation.

Despite the stated advantages of games, their inclusion in the curriculum is quite difficult in Ukraine. In addition to the problems mentioned above, there is also a problem with the lack of specific methods of integrating games into the educational process itself, considering the peculiarities of language and culture.

All the methods that were discussed above are more of a recommendation nature, so all responsibility for the quality of the integration of the training program with the help of video games rests on the shoulders of the teachers. This is mostly due to the youth of the video game industry and the peculiarity of the introduction of innovations in the field of education.

### 4. "SMART PM CITY" IMPLEMENTATION STAGES

Gamification in education requires a consistent approach so that games are effectively integrated into the learning process and achieve educational goals. Based on the researched literature, a board game called "Smart PM city" was developed at the project management department of the Kyiv national university of construction and architecture. The main stages of this implementation are described below.

The first stage includes the definition of educational goals. As part of the study, it was determined what educational results should be achieved with the help of a board game. These are cognitive skills, social skills and specific knowledge in the field of project management. It was clearly defined what role the game will play – it will be the main or auxiliary method for reinforcing and testing knowledge.

The next stage is the direct game development. An analysis of existing board games such as Sea Wolf was conducted, where it was determined that these game models do not meet educational goals. So, it was decided to develop our own game based on the educational material. In this process, the age characteristics of the players, the complexity of the game and the time required for its implementation were considered.

Next, the game adaptation to the educational process. After the game was developed, it was adapted to the curriculum. The process of improving adaptation is still ongoing. For this purpose, rules corresponding to the topic of the lesson and the course were implemented. The desktop is organically combined with other educational methods and has been integrated into the structure of the lesson and course.

For a high-quality game process and skill acquisition, participants learning must be provided before the first game, which is also the fourth stage in the implementation. Before starting the game, students must clearly understand the rules of the game, as well as what educational goals it helps to achieve. The developers of the game conduct a short tutorial, explaining the mechanics of the game, its connection with the educational material, and discussing what the students will get as a result, which is the construction of a smart city.

As the fifth stage, we can assume the game features adding/adjusting. The game was implemented in an educational environment. It was both part of the lesson and a separate game session. During the game, the teacher should observe the process, help the students and, if necessary, adjust the rules or the approach to achieve the desired results.

Stage six is game reflection and discussion, which contributes to improved assimilation of information. After the game is over, it is especially important to have a discussion. This helps students to understand why the game was useful, what skills they developed or what knowledge they gained. Students can discuss the strategies they used during the game and how these strategies can be applied to real-life situations or learning.

Results evaluation is the seventh stage. Analysis was constantly carried out to what extent the game helped to achieve the set educational goals. It was implemented through observation, tests, questionnaires or surveys of students about their impressions of the game and the learned material. Assessment could be both individual and group, depending on the nature of the game and educational goals, and was conducted by both students and teachers. The assessment criteria were how the game affects students' cognitive skills, learning and motivation. These indicators are presented in figure 1.

The eighth stage is game adjustment and improvement. Based on the evaluation results, the game systematically improved, namely, changes in the balance of game prices for resources and buildings, changes in the rules, and adaptation to new educational needs. The game turned out to be successful, so it was decided to apply it to other groups of students and use it as a permanent educational tool.

The last ninth stage is game support and reuse. The game can be used regularly to support motivation in learning and consolidate, verify and deepen the knowledge of both students

and specialists. It is also worth considering the possibility of modifying the game for other topics or disciplines.

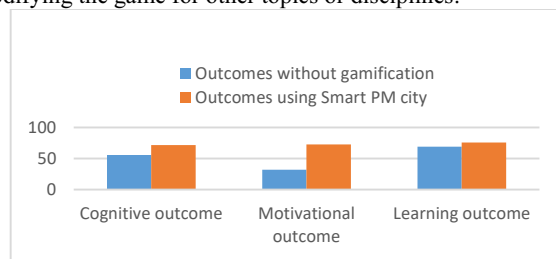


Figure 1. Results of game implementation in educational process

## 5. CONCLUSION

Implementing games in education is a process that requires a clear strategy and planning. The use of games must be justified from the point of view of educational goals, as well as effectively integrated into the overall educational process to achieve maximum results. Implementation of the game in curriculum will have positive aspects, such as: development of skills needed by students for future professions, development of critical thinking, increased interest in learning, increased level of socialization and development of team cooperation. It is necessary to consider the risks of quality deterioration of the education due to the imperfect game implementation in the educational process, so to prevent this, a reflection and evaluation of the results was carried out. One of the areas of the game development will be its digital adaptation to improve the gameplay.

## Literature

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