

The Significance Of Using Gamification Elements In The Educational Process

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Abstract—Gamification elements are used in various fields. Game technologies can also be used in the educational process. How to make lessons interesting with the help of gaming technologies? The article provides an answer to this question. A geometry game was developed and the game mechanics were analyzed. Several solutions have been proposed to combat the destructive strategy. The main constructs of gamification are shown, such as intrinsic and extrinsic motivation, attitude, self-efficacy. On the basis of the developed game, experiments were carried out with students. On the basis of the experiment, the effectiveness of using gamification for the formation of sustainable internal motivation of students to systematically solve problems is shown. Examples are given that illustrate the content aspect of the presented model - fragments of author's developments. The application of the developed game as a material for repeating the topic for the lesson of analytical geometry for traditional education is considered. Based on the results of the study, conclusions were drawn about the benefits and effectiveness of gamification in the classroom. Prospects for the development of the research topic and directions for further activities are outlined. Scientific work can be useful for programmers developing e-learning tools.

Keywords—gamification; game mechanics; destructive strategy; activity cycles

I. INTRODUCTION

Game technologies are a component of pedagogical technologies. The use of game technologies in the learning process in pedagogical theory and practice is not

a new phenomenon. The place and role of game technology in the educational process, the combination of game elements and the educational process largely depends on the teacher's understanding of the function of pedagogical games. The function of the game lies in its multifaceted benefits. In current practice, there are various types of games: business, attestation, organizational activity, stress relief and formation of innovative thinking, research and approbation, etc. innovative, reflective games [1].

All people, regardless of age, love to play. Since childhood, people have associated the term "game" with positive emotions. In addition, the player clearly understands that it is possible to make mistakes in the game, lose, but then try again and succeed. Therefore, the game eliminates the fear of making mistakes, which in fact is the main obstacle to activity. The process of acquiring new knowledge is easy and imperceptible for the student. Further, the learning process is self-motivating - the better a person understands a certain subject area, the more interesting it seems to him. If so, as a method of teaching through the game, as a natural and accessible source of knowledge, it opens the interest to involve in the learning process, to increase the motivation to study the subject, and therefore to participate in classroom lessons. In scientific work, game mechanics is explained as a way of implementing a part of the game process [2]. An approach has been developed to define the concept of game mechanics from the point of view of the object-oriented programming paradigm, where game mechanics are defined as methods used by players to interact with the game world [3]. Scientific work shows that game mechanics are an element that makes the educational process interesting. Many game mechanics are also described [4]. Studying them, we can conclude

that the main element of the game mechanics is a virtual score that brings positive emotions to the learner. Thus, the purpose of the game mechanics is to increase the enthusiasm for the game. Indeed, the effectiveness of independent learning of students using electronic resources directly depends on their motivation. Gamification elements should be actively used in the created and developed e-learning tools. Research by many scientists shows that most e-learning tools do not have didactic games [5]. Let's consider the method of using gamification elements to organize students independent work on forming the ability to make calculations [6].

A. Basic Elements Of Gamification

For the use of games, there are usually many options and alternative solutions, from which you have to choose the most rational one.

In addition, one game can perform several functions:

- teaching function - development of general educational skills such as memory, attention, reception of various modal information;
- entertainment function - creating a comfortable atmosphere in the classroom, turning students into an interesting adventure without boring them;
- communicative function - to unite students and establish emotional ties;
- relaxation function - removal of emotional stress caused by stress on the nervous system during intensive training;
- psychotechnical function - formation of skills to prepare the physiological state of players for more effective action, restructuring of the psyche to assimilate a large amount of information [7].

And the elements of gamification and their characteristics are shown in the fig. 1 below.

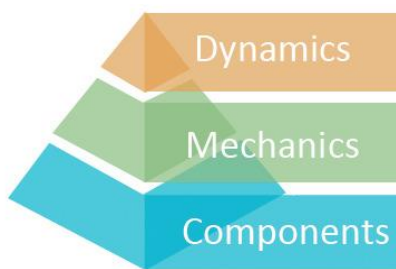


Figure 1. Pyramide of Werbach

Creating game models requires an understanding of the structural components of a game that determine how it works. Professor Kevin Werbach of the Wharton Business School of the University of Pennsylvania, who conducts an open course on gamification as part of the Coursera online education project, suggests considering all the elements that make up a game in the form of a conditional pyramid consisting of three layers, as shown in Fig. 1. A summary of his lecture presented at www.hubpages.com clearly shows this pyramid: the top level is dynamics, the middle level is mechanics, and the bottom level is components.

The "Dynamics" layer is a hidden structure that harmonizes the effects and experiences of the game. This layer includes:

- Restrictions. Every game has limitations because the game must create meaningful choices and challenges by limiting the freedom of the players.
- Emotions. The game has a limited range of emotions.
- Chronology (narrative) is a structure that unites the parts of the game into a single whole.
- Progression. The player began to feel that there is an opportunity to mature and grow at what level he is.
- Communication - common connections between people.

The "Mechanics" layer refers to the actions that advance the game action and includes:

- Challenge - goals that players in the game strive for;
- Random - elements of luck and generation of random values and parameters;
- Competition;
- Cooperation;
- Feedback – the ability to see how things are doing in real time the player wins;
- Resource mining is the process of providing or gathering resources for players to advance the game;
- Transactions - buying, selling, exchanging something;
- Win-win situation.

The "Components" layer shows the implementation of game dynamics and mechanics and includes the following sections:

- Achievements;
- Collections;
- Discover new content;
- Gifts;
- Ratings of leaders;
- Levels;
- Points;
- Quests;
- Social relations;
- Teams;
- Virtual goods and benefits and more.

Game components mean that the pyramid should support and expand one or more elements of the upper level concepts, lower levels [8].

B. Important Components of Gamification and Research

Motivation

Motivation can be expressed by the fact that a person is engaged in something and persistently works for it. According to the theory of self-determination, motivation can be divided into two categories: extrinsic and intrinsic[9]. The former is derived from external incentives and rewards, while the latter relies on the satisfaction associated with the activity itself, which satisfies basic psychological needs. Most of the research is devoted to determining the internal motivation associated with students' interest in performing learning activities in the game system. Given the association of gamification with the hedonistic experience of video games, this approach to intrinsic motivation seems like a reasonable strategy for getting things done.

However, some researchers argue that elements of gamification based on reward systems are associated with extrinsic motivation, which may also affect learning effectiveness.

Position

In social psychology, attitude refers to a person's position toward or against a target, which may be a phenomenon, person, or object[10]. Individual approaches to gamification are presented in different ways in scientific articles. More broadly, some studies measure attitudes toward gamification experiences as user preferences and overall acceptance or satisfaction. In a narrower sense, some studies focus on specific but different aspects of gamification, such as approaches to lessons and academic subjects.

Engagement

Activity can be defined as the effort students use to achieve learning outcomes. Azevedo explains that participation is widely misused and overgeneralized by the educational community, including researchers[11]. The authors argue that the construct is multifaceted and suggest that engagement can be defined in three ways: behavioral, emotional engagement, and cognitive engagement. A few years later, Reeve and Tseng introduced agentic engagement, which occurs when a learner actively participates in the learning process while learning.

Taking into account the above components and game mechanics, we have added the main ones to our game.

II. PROCESS AND RESULTS

The article presents a game for the analytical geometry lesson created with elements of gamification. This game can be used as a review of past material after the lesson is explained. According to Werbach's pyramid, "game mechanics" were analyzed and components were introduced. The game is completely developed in the Kazakh language. You can see first page in fig. 2.



Figure 2. First page of game

The game is divided into different stages. The first part of the game looks like in Fig.3. Accordingly, I added the basic problems of analytical geometry. The distance between two points, the equation of a straight

line, determining the length of the leg and hypotenuse, etc. The game is based on the principle of easy to difficult, because if we immediately give a difficult task, the motivation of the learner will be lost.

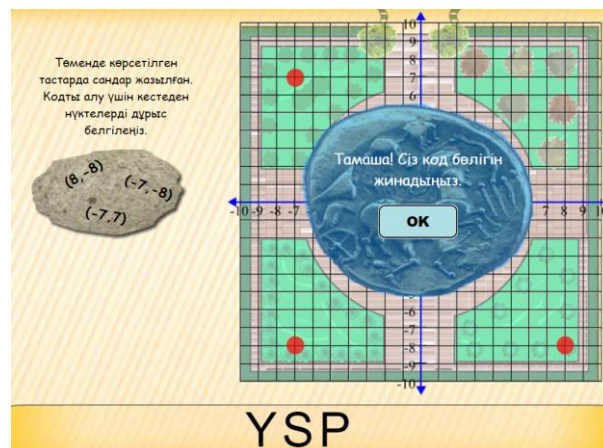


Figure 3. First part of the game

- "Feedback" mechanics - feedback is given if the answer is correct at each stage of the game. If an error is found, you will be reminded to repeat the topic.

- "Success" mechanics - letters are awarded for each correct answer to advance to the next stage. You will be prompted for a password when all reports have been retrieved. The password is the scientist's name consisting of letters. In our case it is Pythagoras. The letters that make up the password are shown in Figure 3, while Figure 4 shows all the collected letters.

- "Challenge" mechanics - students should clearly know the goal to be reached at the end. As shown in Fig. 2, the mission of the task should be written. It inspires learners.

A game should always include two cycles: progress cycle, participation cycle. In the progress cycle, not all tasks are given at once, they are divided into small parts. The influence of motivation and feedback is abundant in the cycle of participation.

The second stage is dedicated to finding the distance using coordinates. If the distance is correctly found, the little man in fig. 3 will rise up. The main motivation in this stage is to reach the goal in the left corner.

Fig. 5 shows the final stage. Given the equations of the line, we need to write down the corresponding laser number. There are also other questions: the point of intersection of the line with the axes, the angular coefficient, the canonical form, etc.

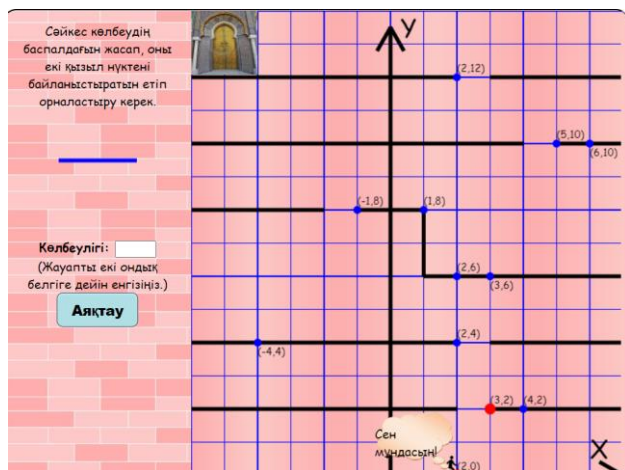


Figure 4. Second part of the game

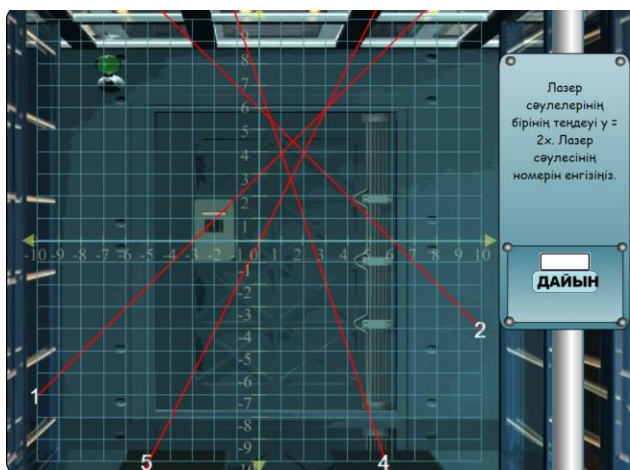


Figure 5. Final stage

Both types of activity cycles were used in scientific work. All three components in the participation cycle were used to engage the learner in the process. In the progress cycle, we have divided it into 3 levels to achieve the goal in the game. Therefore, the developed game fully meets the criteria of the activity cycle.

The downside of gaming technology and how to deal with it

Despite all the advantages of using game mechanics, they create destructive strategies. Here, the destructive strategy is interpreted as a behavioral algorithm aimed only at obtaining a virtual asset[12]. Destructive strategy is one of the weaknesses of gamification that occurs when students are too focused on the process of playing the game rather than the learning process. Using infinite possibilities, one can find the answer by typing random numbers instead of solving the problem. To avoid this, the number of opportunities in the game is limited. The maximum number of opportunities in each report does not exceed three.

The root of the problem of the emergence of destructive strategies lies in the immaturity of the educational process with added game elements. It should also be noted that the emergence of destructive strategies is not a significant drawback of gamification tools. In general, emerging destructive strategies can be addressed in several different ways. Thus, when destructive strategies based on some specific game mechanics

appear, its role should be reduced, less attention should be paid to it, and its use should be avoided. Repeated use of any game will surely make students bored.

A. Experiment

An experiment was conducted based on the created game. 9th grade students of 113 schools-gymnasiums were taken as a sample. The number of participants in the experiment is 150. During the experiment, their interest in the lesson increased and their zeal was awakened. Attendance reached 100%. Motivation increased and even low-achieving students tried to understand the topic. Based on the answers to the questionnaire, 85.6% of students are familiar with the elements of gamification. When asked which stage of the game, 64% answered that it was the second stage.

III. CONCLUSION

Thus, the game developed on the subject of geometry using gamification (a set of game mechanics) significantly increased the enthusiasm of students and achieved high educational results. The experience of using gamification elements in the educational process presented in the article showed the need and great possibilities of using game mechanics in electronic learning tools. As a result, the following conclusions can be drawn:

- gamification enriches the process of learning mathematics with positive emotions;
- Forming students' mathematical literacy with the help of gamification, we immerse students in a typical game environment, thereby reducing tension and stress factors;
- in general, gamification provides instant feedback when students repeat their acquired knowledge, which has a positive effect on the progress and management of the educational process;
- with the help of games designed in a certain way, you can get side effects: increase reaction speed, improve skills, develop students' abilities;
- the content and plot of the games contribute to the activation of cognitive processes.

Prospects for further research on this topic may be as follows:

- development of an information gamified system for pupils and students and testing them in further distance learning;
- creating methodological guidelines for the use of gamification in mathematics lessons, extracurricular activities and independent work processes

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