Chapter 4

Gamefication of education as necessary condition for higher education systemm modernization

4.2. Gamification in high school

Access to modern information technologies has undoubtedly changed people's lives and continues to change them for the better. This process leads to the transformation of academic approaches in the higher education system, contributes to the improvement of soft skills, which increases the value of future graduates on the labor market. As the scientists note, "the approach to acquiring new knowledge, which uses a direct influence on a person's interest in the process, motivating him to continue the process and forming satisfaction with what has been achieved, allows you to significantly increase efficiency, including the speed of assimilation and the quality of acquired knowledge" [3]. In the process of games, participants can try on a certain role, which is endowed with new qualities that are not available in real life. Such qualities provide an opportunity to try the desired model of player behavior with certain features. That is, as stated in [5], "gamification of learning consists in creating elements of entertainment that are found in games and transferring them to real life in the formation of knowledge and skills needed in production activities".

At the beginning of the XXI century. game-based learning and game-based learning were widespread. However, the range of games available today to both children and teachers has expanded significantly compared to the end of the 20th century. This is primarily due to the development of information and communication technologies and the availability of various individual electronic devices. In recent years, gamification methods have become widespread as a means of increasing motivation and involvement in learning. The term "gamification" first appeared in 1912, when the well-known company "Cracker" began to include a surprise toy in its own products, which later became popular among other companies as well.

Gamification gained real popularity in 2010 thanks to examples that clearly demonstrated the nature and effectiveness of the phenomenon in action, and was integrated into numerous diverse structures and presented to a wide audience [3].

In 2010, the term "gamification" came into use rapidly, which includes the use of game mechanics in non-game areas. As noted by L. Sergeeva [1], "early examples of gamification were based on rewarding people who shared their experiences on platforms such as Foursquare and Gowalla. A person "chickens" in a certain institution and receives reward points for this, after achieving a certain number of rewards, he is awarded a medal with status. According to Gartner's conclusions, in the early 2010s, gamification became one of the key trends in information technology for organizations, and by 2015, up to half of all organizations will use gamification technologies".

The current stage of information society development, the COVID19 pandemic, and the war in Ukraine gave impetus to the development of educational trends, including "distance and mobile learning, MOOC, augmented reality, cloud LMS, personalization, BigData, gamification" [2]. This changes not only the content of education, but also affects its quality, leads to a decrease in the effectiveness of the methods traditionally used in teaching students. "Strict regulation of the activities of students of higher education in classes, mandatory educational procedures often lead to a lack of understanding by the latter of the goals of their actions, to insufficient awareness of the need for the studied material and its practical significance. As a result, there is a lack of motivation to study, as well as the skills of planning one's activities" [2].

Recently, global IT campaigns have been actively working in the direction of gamification to improve existing educational platforms and create new game training programs for use in an open information and educational environment. Currently, the most famous are Classcraft, Minecraft: Education Edition, Power Point Quick Starter, Paint 3D, LinguaLeo, Lego Education WeDo 2.0., SimCity, etc.. Such products have become an integral modern toolkit for teachers and students in the class of the 21st century . Narrowing the scope of our research, let's focus on educational gamification [2].

Gamification (or gamification, from the English gamification, gamification) is the application of approaches characteristic of computer

games in software tools for non-game processes. This is a set of motivational management techniques borrowed from computer games and their creators. For example, points, medals and other attributes of virtual victories can serve as a form of intangible "gamified" encouragement: you sold two stars last month, and he sold three. Medals, badges, points – anything, the main thing is that people start moving while playing. Play makes routine come alive. Not wanting to go far, Kevin Werbach cites his own training course at a business school as an example10. Gamification will simply make the work more pleasant and exciting, because the game concentrates many points of motivation – competitiveness, prize incentives, the logic of overcoming obstacles. Simply put, work does not become a game, but the employee now begins to work as if playing.

Management resorts to gamification as a way to develop and systematize its motivational policy. For example, the UK Department of Work and Pensions created an innovative game called "Idea Street" to decentralize innovation and generate ideas with the participation of all 120,000 employees of the organization. "Street Idea" is a social platform for collaborative activities with an admixture of game mechanics. What tasks will be solved using game mechanics – gamification of business processes?

Gamification allows quite easily, without coercion, to solve such tasks as [1]:

– to increase the general level of labor productivity;

– identify leaders in one or another area;

– determine the vector of development of each specific employee and the team as a whole and stimulate them to develop in this direction;

– provide all employees with prompt feedback on the results of their activities;

– increase the visibility of the work results of each employee;

– improve the quality of communication in the team;

– reduce the number of conflicts;

– unite employees with a common idea, involve teamwork;

– to instill the company's values in employees, to form an understanding of the HR brand at the level of already working employees.

Gamification manifests itself in three forms:

1) competition, the main component of game motivation, which uses such elements as tournament tables, clear goals and rules;

2) "win-win" type mechanism, a game without a winner, which is pleasant in its process;

3) aesthetics, the purpose of which is to visualize, make clear and pleasant the goals, tasks, vector of development, to increase the visibility of the results of the employees' work.

In fact, gamification meets us almost at every step – and is not limited to fashionable and completely traditional educational methods. Those who own credit cards at supermarkets, collect drink caps to win a car, or "cheek" to get a free espresso at a cafe are also involved using the same technique. Gamification is used wherever a game or competitive element is introduced [1].

There are various ways to improve learning efficiency. One of the most promising approaches is gamification, the use of computer games in education – Digital Game Based Learning (DGBL). Computer games for learning are the result of gamification, which is used in many areas of human life. Gamification (from the English Gamification) is the application of approaches characteristic of computer games in software tools for non-game processes with the aim of attracting users and consumers, increasing their involvement in solving applied tasks, using products, services [3].

However, gamification, like any method, in the educational process has positive and negative sides. Positive aspects include the worldwide popularity of computer games that increase the effectiveness of education; the fact that all children have played computer games at least once, so they understand the principle of action; open interest of the student, involvement in the process at each stage of task performance [2].

Psychologists pay attention to the negative aspects and note that gamification is a highly psychological principle. It is clear that many people like computer games, and therefore the idea of introducing game dynamics into education, and thus changing the educational process for the better, is quite interesting and attractive [2]. But if you look deeper, you have to face the negative consequences of using the psychology of games in education:

– the presence of external motivation in the form of awards (points, badges, next levels, etc.), which are usually necessary, but the internal motivation of students to study is more important;

– neglecting the use of awards in education because the student must clearly understand what exactly he is receiving an award for;

– gamification psychologically undermines behavior, because many students can focus on receiving rewards, and not on learning itself. The idea of using games to encourage learning has a long pedagogical path and has not lost its relevance to this day.

Purposeful adaptation of games in the context of learning reached a new level with the advent of digital media. On the one hand, this new digital way of learning, based on the enjoyment of playing the game, opens up new aspects of the learning process. On the other hand, it remains questionable whether learning through a game can really improve learning efficiency [2].

Why gamification works:

1. Increased activation of players.

2. Multifunctionality.

3. Additional motivation.

4. Simple transmission and assimilation of information.

5. Simple and interesting form.

According to Bugaichuk K.L. the main principle of gamification, from a software point of view, is to ensure receiving constant, measurable feedback from the user, which provides the possibility of dynamically adjusting his behavior. The main aspects of gamification [4]:

– dynamics – the use of scenarios that require users' attention and reactions in real time;

– mechanics – use of scenario elements characteristic of gameplay, such as virtual awards, statuses, virtual goods;

– aesthetics – creation of a general gaming impression, which contributes to the emotional involvement of the user;

– social interaction – a wide range of techniques that provide user interaction characteristic of games.

Gamification is often identified with the related terms "game", "learning based on a game", but they differ from "gamification" by certain criteria [4], the differences are shown in the table. 4.1.

Let's determine how gamification resembles traditional game practices and how it differs from them. Gamification is not:

– immersion in a three-dimensional virtual world (for example, second life);

– games while working or studying; – use of games in a business context (for example, McDonald's Monopoly);

Table 4.1

**Differences between the terms "game", "game-based learning"
and "gamification"**

Game	Game-based learning (learning through real play)	Gamification
For fun, may or may not have strict rules Winning or losing is part of the game	The game defines educational goals (objects)	It can be a set of tasks with clear goals and forms of achievement
Winning or losing is part of the game	There may not be a loss, since the goal is the motivation of the student to reach the end of the educational program (achieve the educational goal)	There may not be a loss, since the goal is the student's motivation to take certain actions and achieve educational goals
The game is primary – achievements are secondary	Sometimes the game itself is a non-critical achievement	There may be non-critical achievements
Games are usually difficult and expensive to create	Expensive and difficult to create	Cheaper and easier to do
The plot and its parts (scenes) are part of the game	The content is similar to game scenes	Game elements, for example, are added to an LMS or other learning system that hosts the content

– various simulators used during the training of pilots, drivers or doctors (serious games);

– game theory (a branch of applied mathematics that studies optimal strategies in games).

Gamification is not only used for marketing and attracting new customers, it is not limited to the implementation of points, badges, leaderboards and does not necessarily contain them. Gamification doesn't always work in an electronic format, it's just a tool to increase motivation and engagement.

As noted by N.S. Kravets [6] gamification is the addition of game rules to the existing context with the mandatory presence of a fan, a

connection with reality, and the voluntariness of the game. A fan is a set of rules that make reality more exciting and interesting for players. Contact with reality means that the player performs the same actions in the gamified system as before the introduction of gamification. Voluntariness guarantees the player the ability to abandon the game add-on at any time and return to normal interaction with reality. Only if all these rules are followed can any process be considered gamification. The criteria for distinguishing gamification from games, simulators and traditional education are given in the table. 4.2.

Table 4.2

Excellent signs of gamification

Parameter comparison	Traditional games	Simulators (serious games)	Gamification	Traditional education
Task	exist			
Reverse	the connection is constant, continuous			exist
Purposes	defined			sometimes vague or unclear
The path to mastery	available to everyone			available, if lucky
Rules	clear, transparent, attached to the context of the game		superimposed on the existing context	sometimes uncertain
Failures	expected, encourage action			are punished are hiding
User status	transparent, updated in a timely manner			hidden
Player actions	filled with game content		useful for the existing context, some of the actions are filled with additional game content	useful for the existing context
Narrative (what connects the component systems into a single whole)	exist			if lucky
Voluntariness	exist	no	exist	no

The main components of the process of gamification of education as stated in [5] include: target audience and conditions, purpose of education, tasks of education, resources, implementation. The hierarchy of these components is shown in fig. 4.1. The key to effective learning is understanding the target audience. Age category, social status, previous experience, inclination to study, etc. can be important.
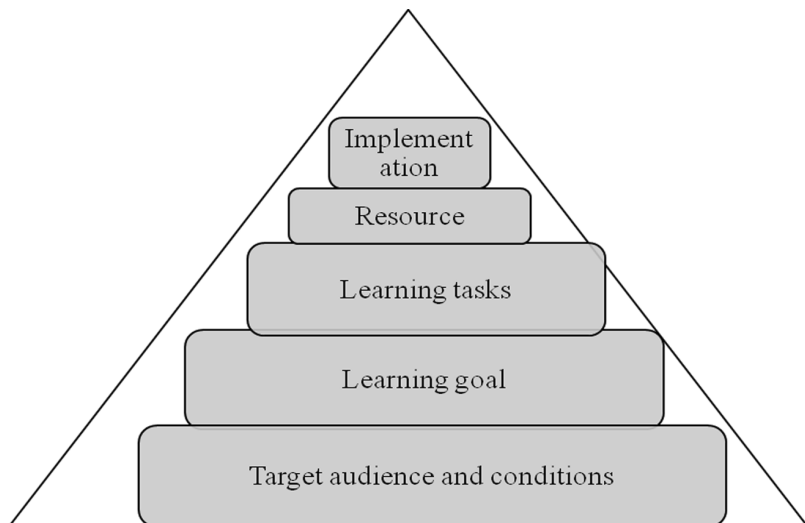
**Fig. 4.1. Hierarchy of components of the process
of gamification of education**

Such information is not sufficient without the conditions under which the educational game should take place. Conditions can both contribute to the assimilation of new knowledge and serve as a factor in weakening the concentration of players and reducing the effectiveness of the game.

The conditions can be the duration of the game, the venue, group or individual game, the number of participants in random group games, etc. Understanding the target audience and the conditions of the game should lead to the determination by the instructor (the person conducting the training) of pitfalls that work to reduce the positive effect of the educational game. Such factors, for example, can be the inability to combine work in the office and studies, lack of motivation, etc.

The next step is to define the purpose and tasks of training. The task of the instructor is for the listeners (game participants) to achieve certain achievements. These can be taking an exam, writing a final paper, developing a project, etc.

Specific learning tasks are usually students' understanding of the principles of the educational discipline, the ability to perform certain tasks or the implementation of the educational program. It is important to clearly formulate the goal and tasks of training. Acquaintance with the target group, the conditions of the training and the formulation of the goal and tasks of the training allow us to proceed to the assessment of resources.

The successful implementation of a game project requires the presence of the following elements. The tracking mechanism is used to monitor the progress of training. In the course of the game, there can be an equivalent of a monetary unit, capable of increasing or decreasing depending on the player's actions (successful or erroneous actions) or independently of him (the passage of time).

A certain amount equivalent to a monetary unit received by the player for correct actions (studying educational material) makes it possible to move to a new level of the game. Interest in obtaining new impressions (game experience) motivates to study the educational material. Thus, dividing the game into levels is one of the motivational factors in game-based learning.

Games usually have rules. Rules in game learning provide players with equal initial opportunities, which serves as an additional motivational drive.

Completing the tasks of the game in compliance with the rules guarantees the study of the educational material. At the same time, the player gets the opportunity to move to a new level of the game (moving to a new topic, etc.). Feedback provides an opportunity for the instructor or teacher to receive information about the progress of the learning process. Students receive reports on their passing of tests, which contributes to effective learning of the material. Since gamification is the transfer of game mechanics to real life, it is necessary to determine which game elements will be used in the learning process. Such elements can be divided into those inherent to the player and social. Individual – these are points, virtual goods, time limits, etc. Social – leaderboards, interactive interaction with other players, etc. The use of a certain type of element implies a certain reaction of the audience, so the selection of game elements should be meaningful and balanced [5].

Today, there are many programs for creating didactic tests, quizzes and games, namely Quizizz, Plickers, Quizalize, Triv.in, Kahoot. For example, "Minecraft: Education Edition" is a common universal educational platform that teachers can use for various subjects in order to develop and form skills of the 21st century, in particular, digital literacy, inventive and creative thinking, performance of actions and effective communication of subjects of the educational process . This educational and gaming resource is constantly being developed and improved by the developers. The game designers made the educational version of the game the most convenient and flexible didactic tool. The technical requirements for devices to download the resource should be as follows: PC with Windows 10, gadgets (phones, tablets, etc.) with Android, iOS, Xbox One on virtual reality platforms. The game is written in the Java object-oriented programming language. Technical parameters allow up to 8 participants to participate in the game at the same time. In the considered educational version, the best functions have been improved, in particular [2]:

– maps with coordinates have been improved for the convenience of designing collective trips;

– improved student portfolios for storing screenshots and photos;

– improved multi-user mode for classes of up to 40 people;

– personalized pages with customized avatars were developed;

– the function of import and export of created worlds has been introduced.

The main didactic idea of this resource is the possibility of carrying out design activities, modeling and building your product. The peculiarity is that students act in virtual worlds, applying the knowledge and skills obtained as a result of studying various school disciplines. Mastery of this game requires knowledge beyond the school curriculum. Often, the player needs to search for and learn something on his own, which brings the student closer to the intellectual challenges that await him outside the school walls in real life. As the developers of MinecrafEDU note, it is an open, educational and developmental platform that promotes the development of creativity, the formation of collaboration skills, the ability to set tasks and find ways to solve them, and also provides ample opportunities for game learning of a wide range of disciplines – from biology to art [2].

More than 7,000 schools in 40 countries around the world use MinecraftEDU to teach children everything from history to art. Educators

from different parts of the world discuss various options for using MinecraftEDU in the educational process and project activities. He comes up with the idea of embodying scenes from literary works in the virtual world, so that children can better understand, feel, remember them and even offer their options for the development of the plot. For example, students at Alfriston College in New Zealand are working with the Auckland Memorial Museum to explore the history of New Zealanders who served in the 1915 Gallipoli Company by recreating the landscape in Minecraft. Middle school students learn the building blocks of computer science in an online Minecraft camp.

Primary school students in Scotland learn about urban planning and engineering by redesigning, reworking and then building in Minecraft and more. Among the obvious advantages of the game are extended study guides for students, trainings and seminars for teachers, practically unlimited possibilities to adjust and adjust the curriculum.

The educational and gaming process with the help of MinecraftEDU is built as follows: the teacher controls the virtual map where his students play. The teacher can integrate his lessons and assignments to this card. In order for teachers not to do extra work, the game offers a rich library of previously created "worlds", as well as the development of previously created lessons. MinecraftEDU learning worlds provide a wide range of opportunities. For example, finding the perimeter of a particular area or distinguishing dinosaur remains from other fossils. The teacher gives each student access to buildings and locations on the virtual map, thereby directing his actions. This makes it possible to teach many individually at the same time [2].

There are many services that use gamification, including:

Codecademy – learning programming in JavaScript, HTML, Python, Ruby https://www.codecademy.com/

Motion Math Games – mobile math games make learning fun and exciting https://www.educationalappstore.com/app/motion-math-fractions

Mathletics – a program for schools aimed at engaging children in mathematics through games and challenges https://www.mathletics.com/uk/

Khanacademy – free video courses on various subjects https://uk.khanacademy.org/

Spongelab is a platform for personalized science education https://www.spongelab.com

Foldit – solving scientific problems as puzzles https://fold.it/puzzles.

Among them, a number of services for learning foreign languages can be singled out, namely:

LinguaLeo https://lingualeo.com/ru. The most popular online resource among young people for learning English. The platform uses game mechanics, thanks to which the learning process is faster and more interesting. The user can not only perform grammar exercises or read texts, but also watch video clips and listen to audio books.

Duolingo. A fairly well-known game site for learning a foreign language. Each lesson consists of listening, translation and conversational vocabulary tasks. You can learn about 2000 words in one course.

LearnEnglish from the British Council. A global platform for learning English. First, it is offered to take an online test to determine the language level, and then the necessary courses available in the country are selected – from everyday English to preparation for taking the IELTS exam. There is an opportunity to study online with an English teacher.

BBC Learning English. The course offers interactive and visualized exercises that improve listening, reading and learning new words; one of the sections is dedicated specifically to work on pronunciation. It is also suggested to take the 6 Minute English course – six-minute videos on various topics.

Exam English. A great platform for those preparing for international language exams like IELTS, TOEFL. You can also take online tests and determine your current level of English.

Livemocha. A social network for those who learn foreign languages. Here you can find a "partner". For example: you study English, and someone – Ukrainian. You help each other in real time. Video or audio chat available.

Bussu. A similar platform for learning a foreign language: you look for an interlocutor and develop common English. In addition, lessons for memorizing vocabulary and pronunciation are available on the site, and the completed exercises will be checked by native speakers.

LyricsTraining. A little-known, but no less fascinating site for learning the language. On this platform, the language is learned by listening to music and watching video clips: you have to insert the missing words in the lyrics of the song while it plays.

In the scientific literature and from the side of practitioners, opinions are also expressed regarding the caution of using gamification and the criteria for its effectiveness. For example, it is noted that the active use of badges and leaderboards in classes with adults almost always greatly increases competition. Yes, the spirit of struggle will encourage students to do tasks faster and better, but if one of the participants gets a result that is very far from the leaders of the list, then under certain attitudes this person may lose heart and decide that there is no point in studying. In addition, real educational programs built on gamification should contain a plan (algorithm) for achieving real educational goals and changing the behavior of students [4].

The opinion is also expressed that the mechanics mentioned above, such as PBL (Points, Badges, Levels), work in the short term. That is, a much more complex game is needed, with a deep processing of the legend and motivation of employees-gamers for a specific task. For example, in corporate training, gamification is perceived as an additional motivation for employees to work, but in fact, according to the results of research, the main motivation factor is control over one's life. And in order to increase it, it is necessary: for stability-oriented employees – to make the future of the company and themselves in it predictable. This requires open communications and quick feedback from top management to all levels of the hierarchy; for development-oriented people – the opportunity to influence their career, salary and overcoming organizational barriers. And for this, employees need to be given more autonomy and, again, open communications are needed to remove all barriers to their development [1].

Based on this, we can conclude that gamification should not be primary, but rather optional. Thus, it is quite effective for visual recognition of student's (student's) achievements, organization of competitions within the training course, design of training content. But we believe that, in fact, in the educational process, clear clear educational goals, the reality of the obtained results and their possible application in life and professional activity come to the fore, in addition, important organizational changes in educational organizations and units (support for teachers who design effective educational programs, design of high-quality educational facilities, development of the educational institution's information and communication infrastructure, etc.) [4].

Gamification is one of the pedagogical tools that does not have negative properties, but it should be used consciously: it should attract, not distract,

it should be meaningful. The following models can be used to introduce gamification methods into the educational process of universities:

– apply an educational gamified system (for example, Lingualeo, Codecademy) as a useful application within the framework of the blended learning model;

– create an educational gamified system by students (for example, staff and students of Texas A&M University developed the game "ARTé:Mecenas", which allows you to follow how the Italian economy during the Renaissance influenced the development of art, acting on behalf of the Medici family);

– apply individual game elements, embedding them in the LMS;

– add game elements to the educational process, eliminating the negative features of the traditional system compared to the gamified system.

The choice of game mechanics is not an alternative to the academic style of presenting the material, but an additional "ingredient" that should be used in limited quantities.

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