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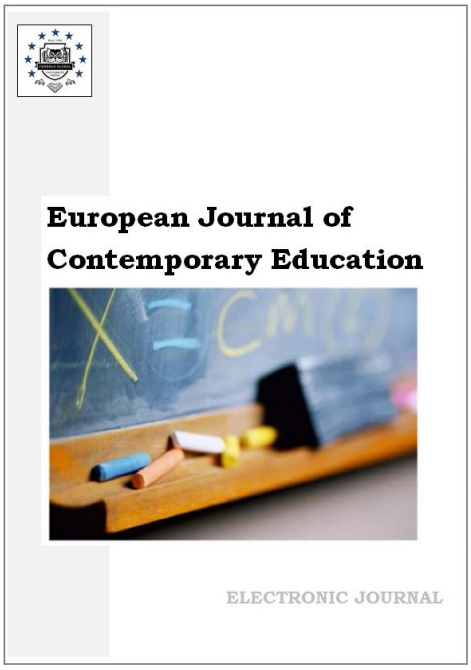

Using Game Mechanics in Professional Training of Future Teachers Working with Gifted Children

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Abstract

One of priority tasks of modern society is creation of conditions which help identification and development of gifted children. Training of teachers during which there is an expansion of students' professional competences in diagnosing, supporting abilities and talents of learners, including learners with special educational needs, takes place within the framework of the corresponding master's program. The purpose of the study is to assess the impact of using game mechanics when training master's degree students, future experts in work with gifted children on the quality of their professional training.

The methodology is based on the analysis and generalization of scientific literature on clarifying the essence and potential of the phenomenon of "gamification of education" in the context of UNESCO recommendations and development of the digital school, clarifying principles of game mechanics and their limitations for didactics in general and when teaching learners with special educational needs. For practical implementation of game mechanics the mechanics "Achievement", "Joint research", "Restraining factors", "One time fun – always fun", "User progress" were chosen.

Research results. Gamification of activities of master's degree students of the experimental group is presented by the authors both in the "computerless" format (business or board game, research project, etc.) and in the Kodu Game Lab environment.

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In conclusion the directions for improving training of master's degree students, future teachers working with gifted children are described.

Keywords: gamification, digital school, learners with special educational needs, game elements, Kodu Game Lab.

1. Introduction

The relevance of the study is determined by the following factors:

1. UNESCO recommendations, international rules in the field of education determine that innovative pedagogical technologies (e-learning, distance learning, m-learning, artificial intelligence, gamification, etc.) and digital services provide additional didactic potential to enrich learning-organizational forms (17 Goals to Transform Our World, 2022). These recommendations also include training formats in the context of the COVID-19 pandemic.

2. A special role in realizing the potential of new pedagogical and information technologies is assigned to the mentor/tutor of the digital school (Soboleva i dr., 2017). According to A.V. Kirilenko, a modern teacher needs to have the ability to quickly change approaches to education and development of students, including learners with special educational needs (Kirilenko, 2020). These conclusions largely coincide with the recommendations of UNESCO, the content of the Digital School passport, as part of the Modern Digital Educational Environment project. The provisions of the project define the priority areas that should be guided by innovative teachers when designing lessons, task systems and related educational resources (Pasport Federal'nogo Proekta «Tsifrovaya Shkola», 2018). In particular, the digital school mentor is encouraged to use information technology to identify and develop abilities and talents of students.

3. One of options for special training of teachers who work with gifted children, experts in the image of the future child in the Russian system of higher education is the master's program 44.04.01 Pedagogical Education. Pedagogy of giftedness (Federal'nyj gosudarstvennyj obrazovatel'nyj...). In accordance with the federal state educational standard of higher education in this area, the work programs involve studying the theory and technologies of working with gifted children, methods and techniques for developing their research activities, self-development techniques, gaining experience in managing pedagogical projects and digitalizing science education, developing skills and computer game development skills.

4. Some scientists, in particular, T.H.S. Eysink, A.M. van Dijk, T. de Jong, conduct studies that substantiate the need for gamification when teaching gifted children (Eysink et al., 2020). The authors describe the project of organizing the educational environment "BE COOL!", which combines various game mechanics and information technologies.

5. N.A. Zvonareva, G.S. Kupalov note that gamification of education necessitates the teacher to solve a whole range of problems: technical, methodological, and organizational (Zvonareva, Kupalov, 2021).

Thus, the use of game mechanics in teaching master's degree students, future experts in work with gifted children is not only a compliance with the priorities of the international educational community, but also implementation of the didactic potential of new pedagogical and digital technologies to improve quality of education, development of students, including learners with special educational needs.

1.2. Objectives of the research

The purpose of the work is determined from the need to assess the impact of using game mechanics when training master's degree students, future teachers working with gifted children on quality of their professional training.

Research objectives:

– to clarify the essence and potential of the phenomenon of “gamification of education” in the context of UNESCO recommendations and development of the digital school;

– to study the principles of game mechanics and their limitations for didactics in general and for learners with special educational needs;

– to describe the stages of systematic targeted work on using game mechanics in education;

– to experimentally confirm effectiveness of the proposed system of work and the didactic potential of game mechanics for improving quality of professional training of master's degree students, future teachers working with gifted children.

2. Relevance

2.1. Literature review

The literature analysis was carried out in the following directions:

1) clarifying the potential of gamification resources for education, professional activities of a digital school mentor in the context of international priorities;

2) studying the experience of using innovative pedagogical technologies for identifying and developing gifted children.

2.1.1. Analysis of Russian scientific and pedagogical literature

When studying the didactic potential of game mechanics and related software solutions, it was revealed that one of principles of modern education is stimulation of the cognitive activity of adolescents, the so-called "Generation Z", when using innovative pedagogical and computer technologies (Krainyukov, 2019). A feature of teenagers of the "Generation Z", according to the author, is the clip-like thinking. This is manifested through their passion for video games, short stories, animated videos. E. K. Gerasimova et al. describe methodological difficulties of organizing the learning process and preparing graduates for the new digital society: a decrease in the interest of schoolchildren to study theoretical material, scientific concepts, facts, laws, etc., irritation after long routine work when doing mathematical calculations, distraction of attention to external factors, communication in social networks, chats of mobile games (Gerasimova et al., 2021).

When studying the practice of applying innovative pedagogical technologies for identification and development of gifted children, we note the experience of G.L. Parfenova, O.G. Kholodkova, Yu.A. Melnikova. They determine that inclusion of games in work with talented schoolchildren is, firstly, one of the labor functions of a mentor in conditions of informatization of society, and, secondly, an important aspect of improving quality of education (Parfenova i dr., 2019).

Summarizing domestic pedagogical experience, M.A. Maznichenko et al. note that working with gifted children may require teachers to use both traditional (for example, demonstration, experience, excursion, etc.) and non-traditional (folklore, mythology, films, games) teaching methods (Maznichenko et al., 2021).

In particular, according to G.I. Fazylzyanova, T.Yu. Sokolova, V.V. Balalov, it is recommended that a digital school mentor use information technology to identify, develop abilities and talents of students (Fazylzianova i dr., 2021).

The description of the essence of gaming technologies for didactic purposes, identification of criteria and principles for designing a gaming lesson at university is presented in the work of N.V. Makarova (Makarova, 2021). She points out that "game" is a multifaceted concept, and "game for didactic purposes" implies an extremely accurate choice of content, software services, and special training of the presenter. N.V. Makarova analyzes earlier studies of gamification, supplementing and developing the conclusions of the authors in relation to university training (Soboleva et al., 2017).

N.V. Makarova formulates the ideas of the "7k" conception: the quality of knowledge, cognitive activity, control, correction, teamwork, competition, communication (Makarova, 2021). The scientist emphasizes that only indispensable implementation of these seven principles contributes to the maximum didactic effect of including game mechanics in higher education. She also highlighted the problems of gamification: ambiguity of decisions of the game teacher/presenter, transfer of negative emotions between the participants from the gaming space to everyday interaction (rivalry, threats, etc.), limited time resources for both the teacher and students.

Ya.N. Poddubnaya, K.S. Kotov, A.A. Slukina consider gamification not only from the position of historical development, but also to identify possibilities of including game mechanics in the arsenal of teachers of higher educational institutions (Poddubnaya i dr., 2021).

As part of the second direction, when analyzing the literature, special attention was paid to justification that work with gifted children may require teachers to adapt existing digital services, information materials, game mechanics to educational needs of students (Balakireva, Mogilevich, 2021).

V.S. Yurkevich notes that the problem of development of gifted children is the difficulty of turning their increased mental abilities into real creative abilities (Yurkevich, 2021). The author proposes the idea that a special "search need" should be considered as the basis for motivating such learners with special educational needs. This need is formed through overcoming situations of

misunderstanding by a gifted child when a mentor uses a special style of interaction, through the possibility to choose the level of difficulty of tasks, relative freedom in learning and the obligatory change by the teacher of the knowledge assessment scale (Gali et al., 2019).

E.V. Shmeleva substantiates the need to develop a holistic model of work with gifted children in the digital environment as an important condition for supporting the welfare of the population and ensuring national security. At the same time, there are also opportunities for achieving sustainable development goals (Shmeleva, 2018).

Due to the fact that implementation of the creative, developmental orientation of education according to the recommendations of UNESCO, the content of the passport of the "Digital School" makes high demands on the teacher professionalism, the inclusion of game mechanics in the educational, pedagogical, research, managerial, methodological activities of master degree students, future experts in working with gifted children can contribute to improving the quality of their training in general.

2.1.2. Analysis of foreign studies

The comprehensive and systematic study carried out by M. Del Carmen Pegalajar Palomino was highlighted when clarifying the potential of gamification resources for education, professional activities of a digital school mentor in the context of international priorities. It provides an overview of the most significant approaches to the gamification of higher education for scientific theory and practice (Del Carmen Pegalajar Palomino, 2021). The author analyzes the didactic potential of game strategy, dynamics, mechanics and elements of the game through students' ideas about them. R. W. Mee Mee et al. conduct a similar research on the exmple of school education in Malaysia (Mee Mee et al., 2021). The authors conclude that the concept of gamification is widespread due to development of information technology, software, video games and gaming applications. Gamification involves not only creation of games, but also transformation of the learning process into an exciting adventure for obtaining new theoretical information.

P. Lameras et al. present the results of the study and assessment of natural sciences teachers' opinions regarding the influence of the Simaula environment on the quality of education (Lameras et al., 2021). The authors considered the following possibilities of the game resource: identifying interests, needs and motives of schoolchildren; support of creativity and independent activity, basis of research projects, support for studying and accumulation of theoretical knowledge. Summarizing the findings, P. Lameras et al. conclude that the didactic effect in each direction depends on seven components: the format of training; position of the teacher; role of the student; material for the content of the game world; game mechanics; feedback mechanisms and game uncertainty. Thus, the choice of game mechanics is an integral element of effective game interaction in the learning space. The results Ootained by P. Lameras et al. largely coincide with the conclusions of J. Swacha et al. about effectiveness of gaming technologies in relation to new challenges in the field of education (Swacha et al., 2021).

J. Swacha et al. describe benefits of game-based learning for achieving sustainable development goals (Swacha et al, 2021). Using the example of the Eco City project, the researchers identify the didactic possibilities of gamification for formation of technical skills, information and analytical activities. S. J. Viudes-Carbonell et al. study complexity of designing and developing games that are focused not on entertainment, but on obtaining new theoretical knowledge or developing a skill (Viudes-Carbonell et al., 2021). The scientists notice that there are a significant number of educational games, however, their creators did not always manage to fully implement the principles of didactics, interactivity, and the feedback mechanism. In their opinion, it is necessary to improve the methodology for tracking the dynamics of the state of the game (according to the game mechanics), obtaining operational feedback.

S. Kadum, E. Kopas-Vukašinović, A. Miljković explore the problems of teachers' readiness to work with gifted children (professional, emotional, methodological components) (Kadum et al., 2021).

The work of N. Tanik Önal, U. Büyük discusses various aspects of the interaction of learners with special educational needs: with each other, with parents, with teachers, with peers. The authors give real examples of situations of success and stress, conflicts in the team and personal problems (Tanik Önal, Büyük, 2020). J. van Tassel-Baska, C.G. Quek and A.X. Feng describe the specifics of the work of teachers with parents of learners with special educational

needs. Their study confirms that the task of parents and mentors working with gifted students is to create a common space for cooperation (van Tassel-Baska et al., 2006).

Thus, the analysis of the scientific works listed above makes it possible to identify the problem associated with the need for additional study of using game mechanics when training specialists who work with gifted children.

3. Materials and methods

3.1. Theoretical and empirical methods

The following methods were used in the work: theoretical analysis and generalization of literature to describe the essence and potential of the phenomenon of "gamification of education" in the context of UNESCO recommendations and development of the digital school, to clarify the principles of game mechanics and their limitations for didactics in general and for learners with special educational needs.

The base of the experiment is Vyatka State University, Pedagogical Institute (Faculty of Pedagogy and Psychology). The study involved 44 students, future experts in upbringing and development of gifted children, when they did the course "Development and application of computer games in education." In addition, the acquired knowledge and skills on including game mechanics in the education of learners with special educational needs were used by master's degree students during the pedagogical practice. The bases of practice are: Center for additional education of gifted students, secondary school No. 47 with in-depth study of individual subjects (Kirov), Vyatka humanitarian gymnasium, school for gifted children "Intellect" (the Oryol region), School for gifted children "Leonardo" (Oryol), Oryol State Institute of Culture (Department of Documentary Communications and Social and Cultural Activities).

The study was conducted in 2020–2022. From October to December 2020 (during the COVID-19 pandemic) it was carried out using distance learning technologies. Fundamental factors for including game elements in non-game contexts when training master's degree students – future teachers who work with gifted children: game mechanics (rules) and players.

When designing game educational spaces, the following logic is implemented: Determining the state of the system, Evaluating the states before and after making decisions (based on information obtained during the game cycle), Changing the state of the game (action according to game mechanics), Feedback (player – system, player – player, player – presenter).

For practical implementation of game mechanics, the mechanics "Achievement", "Joint research", "Restraining factors", "One time fun – always fun", "User progress" were chosen.

To identify the control and experimental groups the authors carried out a measurement, the principles and content of which are disclosed in the research program.

The levels "high", "low", "medium" were introduced to determine the quality of training of future specialists. The methodology for determining the levels is described below (program and results of the study). The average age of the respondents was 24 (50 % women and 50 % men). The size and composition of the sample is justified by the specifics of the study. When characterizing the relationships of the features under consideration, nonparametric statistical criteria are used, in particular, the Pearson's chi-square coefficient – $\chi 2$.

3.2. The base of research

The main purpose of the experiment is to test the didactic potential of including game mechanics in the organization of educational, pedagogical, research, managerial, project, methodological activities of master's degree students, future teachers working with gifted children, and to assess changes in the quality of their professional training. 44 students of the training program 44.04.01 Pedagogical education. Pedagogy of giftedness (master's degree level) were involved.

Integration of gaming applications into training was carried out in the same classrooms, using the same equipment and software.

The materials for the test were developed by the authors in accordance with the current standard of higher education in the field of the study.

3.3. Stages of research

At the preparatory stage of the experiment the didactic potential of gamification was determined both for higher education and for the development of gifted children.

The conditions and limitations of including game mechanics in the training of master's degree students were analyzed (readiness of students to design game educational spaces, technical level for implementing the code in a visual constructor, desire for creativity and professional growth).

An important aspect of the study is the subsequent use of games in practice for teaching children, including learners with special educational needs. In this context the materials and results of international, all-Russian projects have been studied. For example, the content of the project "Gifted children – a prosperous Russia" for small settlements of the Khanty-Mansiisk autonomous district, works and nominations of the international competition for gifted children "Young Talents – 2021", etc.

The necessary theoretical material was selected (the history of the formation of gaming, types of game strategies, principles of the game, etc.).

The following software tools are considered: Scratch, Blockly, MS PowerPoint, LearningApps.org, Kodu Game Lab.

Then the authors compiled tasks for the measurement event, based on the results of which it would be possible to form the control and experimental groups. The principles of selecting and designing tasks take into account the content of pedagogical, psychological and philosophical disciplines, the theory and technologies of work with gifted children; trends in the digitalization of education; ideas about the didactic potential of gaming technologies; meta-skills (for example, creativity, awareness and the ability to find a way out of unforeseen situations); features of using digital services in professional activities.

In total, during the test the participants were asked to solve 4 tasks (the corresponding wording and evaluation criteria are presented in the part 4.3.1.). For the correct answers of the first and second tasks the student could receive maximum 3 points. The solution of the third and fourth tasks was evaluated using 5-point scale.

So, as a result of the initial diagnosis, each participant scored from 0 to 16 points. Based on the measurement results the quality of training of future experts who work with gifted children was determined.

It was decided to understand the quality of training as the correspondence of the level of training of the teacher to the requirements of the professional environment in which he/she will work.

Methods for determining the level: from 0 to 6 points (inclusive) – "low", from 7 to 12 points (inclusive) – "average" and in all other cases – "high".

Thus, it was possible to collect data on 44 master's degree students, from which experimental and control groups were formed (22 people in each). The experimental group consisted of 50 % women and 50 % men.

The second stage was devoted to correlating the topics of the course "Development and application of computer games in education" with the peculiarities of organizing training of teacher who work with gifted children.

The third stage of the study covers training of students to develop and use computer games in the didactic process.

4. Results

4.1. Key ideas and structure of the discipline "Development and application of computer games in education"

Game technologies for educational purposes are studied by students of the training program 44.04.01 Pedagogical education of various master's programs when they design and develop computer programs with interactive, visual components. Game elements in a non-game context are used by higher education teachers both as a means and as an object of learning.

We emphasize that it was decided to understand the quality of training as correspondence of the level of training of a teacher to the requirements of the professional environment in which he/she will work.

The following is the structure of the course "Development and application of computer games in education", the training program specialization "Pedagogy of giftedness". By the beginning of the

course, master's degree students (both experimental and control groups) have already studied the materials of the disciplines "Pedagogy and psychology of creativity", "Theory and technologies of working with gifted children", "Technologies for development of research activities of gifted children", etc.

I stage. Pedagogy of the game, the history of gamification in the world and Russia. The game state of the educational space, game elements, mechanics and other basic components of games.

II stage. Analysis of priorities and directions for the development of international education (recommendations from UNESCO and the Organization for Economic Cooperation and Development (OECD), the activities of Erasmus Mundus, centers for supporting creativity and talents) in terms of gamification of knowledge, including learners with special educational needs.

III stage. Inclusion of game mechanics in studying digital services for professional activities (Online Test Pad, mind maps, applications for quick survey and reflection, NearPad, Prezi, Scratch, LearningApps.org).

IV stage. Technical implementation of game rules and interactions for organizing work with gifted children in the Kodu Game Lab constructor.

V stage. Application of software solutions in the course of pedagogical practice.

VI stage. Discussion of the results of including game elements in work with gifted children. Participation in master classes, competitions, open lessons to present game applications.

It is worth noting that the structure of the course takes into account the fact that the academic semester is interrupted by practice in schools, educational centers, camps, etc.

In general, the game mechanics is understood as a set of rules and methods that support the interactive interaction of participants in the game educational environment and the game space itself (characters, design, plot).

At the heart of the "Achievement" mechanics there is a material/virtual expression of the result of the player's action. Achievements are considered by the game educator either on their own or as rewards. For example: a hint during a test, an assessment, additional time to prepare an answer, the possibility to “change” a ticket in an exam, etc.

The mechanics of "Joint research" involves searching a solution to a task, overcoming obstacles.

The "Restraining factors" mechanics is used to ensure that the player (student) corrects the system of own actions. For example, if a participant is significantly and without good reason late for a lesson, then a question is added in the final test of the course.

The “One time fun – always fun” mechanics is focused on achieving the opposite effect: repetition of simple actions that give the game participant positive emotions.

In the "User Progress" mechanics the achievements of the participant in the game educational space are tracked when solving a series of tasks.

Implementation of game mechanics took place both in a "computerless" way (business or board game, research project, etc.), and in the Kodu Game Lab environment. The latter was chosen based on the following criteria: paid/free content, intuitive interface, the need for knowledge of programming languages, support for the rating/points/awards system, the possibility to work offline without the Internet, compliance with the logic of the selected game mechanics.

In addition, the selected visual constructs support the development of 3D games and animated 3D scenes. This circumstance is of no small importance in training and developing gifted children, since they themselves and their parents are oriented towards the professions of the future. For example, a moderator, a game master, a science artist, a startup mentor, a personal tutor in aesthetic development, etc. These professions assume that a graduate of the digital school will be proficient in the basics of working with XBox game consoles and computer design elements.

4.2. Stages of systematic targeted work on the application of game mechanics in education

Let us consider in detail the stages of applying game mechanics in the study of digital services for professional activities and options for designing game worlds (including those for learners with special educational needs) in the Kodu Game Lab constructor.

At the preparatory stage of the study the course teacher chose the mechanics "Achievement", "Joint research", "Restraining factors", "One time fun – always fun", "User progress".

The mechanics "Achievement" can be effectively implemented when studying the system of paragraphs, sections, chapters. For example, if the school uses a textbook that has 24 paragraphs with questions and assignments, 2 review works, and at least 3 tests. In addition, electronic textbooks, tests, tasks with a detailed explanation may be involved. It is useful for the teacher to introduce a separate grading system, for example, as follows:

- for answering a theoretical question a student receives 2 points (the answer is full and correct, confident);
- for correct, independently solved problem, a student receives 3 points (methodologically correct solution, i.e. there is a short note, a detailed graphic explanation, the answer is in the appropriate units of measurement);
- an additional report on the topic – maximum 3 points (the report is structured, correctly designed, logical and reasonable conclusion);
- correct performance of test tasks – each participant receives 2 points.

Based on the results of using this mechanics in the course "Development and application of computer games in education", a score rating was formed for the master's degree students of the experimental group. Before the exam the game teacher chose three winners. They were offered the following prizes: teacher's help in preparing a research paper, access to additional information sources at the next test, etc. For the rest of the participants in the experimental group, the bonus was an increase in the time to prepare and defend the game project.

The "Joint research" mechanics in the course "Development and application of computer games in education" was used to master the functionality of the new software tool by the students of the experimental group. The game teacher prepared a route sheet for studying, for example, Kodu Game Lab. Following the instructions, the participants (or the group) could design their own learning path: the pace, the quality of problem solving, number of game levels. A variant of the sequence of steps in the instructions: launching the application; creation of "New World"; work on the basic playing field with the tools "Hand", "Brush"; scaling; removing and adding new fragments to the base field; studying icons for creating and changing the landscape of fields, adding a reservoir; saving the game world.

The following is a variant of applying the game mechanics "Joint research" in work with gifted children (from the report of the master's degree students of the experimental group on practice at the school for gifted children "Leonardo"). Research problem: determine the height of the tree if the length of the shadow and the height of the researcher are known. Motivation: Test Jules Verne's theory presented in the novel "The Mysterious Island", where the engineer measured the height of the Distant View site. Place of the game: school stadium or the nearest park (alley). The teacher divides all students into 3-4 groups in advance by drawing lots according to colored flash cards (resource https://color.adobe.com/en/explore) or based on the class list (https://ciox.ru/split-a-list-into-groups).

In class the teacher identifies the trees to be measured. There is a clear explanation of the rules, goals and objectives for the game. Necessary measuring instruments and tools are selected. The homework task is to arrange the research materials in spreadsheets. The use of mechanics provides additional opportunities to rally the team, to show cognitive/physical activity, to test research abilities and non-standard thinking skills, to gain new knowledge in a playful way. The winners can be awarded according to the option specified earlier for the "Achievement" mechanics.

To explain the game mechanics of "Restraining Factors" we will describe the content of the game "Contact". The game teacher thinks of a concept (noun, common noun, singular) and calls out loud its first letter. The task of participants is to guess the term/definition by remembering other words starting with this letter, asking additional questions. The task of the presenter is not to reveal the following letters in the word to the players as long as possible. For example, letter «C". One of players asks the question: "Is this a direct continuation of the plot, the second part?". The game educator needs to quickly figure out what the player means and say: “No, it is not a Sequel (if it was a Sequel, then you should admit it). Other players also ask questions. And, if they understand before the teacher what “Sequel” is meant, then they say: “Contact” or “There is contact”. Next, participants count in chorus to ten, and then call the word. If at least two opinions of students coincide, then the game teacher, according to the rules, reveals the next letter. The prerequisite for the game (deterrent) is “contact” between two students.

The mechanics “One time Fun – Always Fun” can be used to reinforce previously acquired knowledge. Students, moving around the classroom, at each step (turn, bow) name a term, concept, phenomenon, etc. from the studied material. For example, gamification, game technology, game plot, game genre, etc. The condition for implementation of the mechanics is that participants repeat the same simple (pleasant) action several times.

The mechanics "User Progress" allows in a playful way to check the quality of memorization of rules, algorithms by students. Possible course of the game:

1. The teacher, using a random number generator (https://randomus.ru/), determines the main character – the Player.

2. The player leaves the classroom for a while. At this time necessary items and tools are being prepared.

3. The teacher and other participants choose an algorithm, a rule that can be implemented using the available materials. For example, the algorithms "Towers of Hanoi", "Carrier", "Linear search for an element", "Sorting by the simple exchange method", etc. Practical situations in which this algorithm can be useful (in education, at home, while traveling) are thought out.

4. The player enters the classroom. The teacher explains what he/she should do (find the necessary tools; guess the algorithm). The rest of the students tell the Player the possible application of this method, algorithm in life. The player makes guesses.

5. The guessed algorithm/method is demonstrated by the Player using the selected materials. For recording and design, virtual boards can be used (https://limnu.com/, https://www.twiddla.com/).

The mechanics allows to test retained knowledge. During one lesson master's degree students (from the experience and practice at the Oryol State Institute of Culture) played two or three games with different methods, algorithms, and sets of rules. The participants of the experiment noted that this form of control effectively develops logic, memory, thinking, and intelligence; communication skills and digital skills are formed.

For the technical implementation of game mechanics the master's degree students were offered the visual constructor Kodu Game Lab. Let us give an example of one of the game projects that was designed and applied during pedagogical practice by future experts who work with gifted children (the experimental group).

The project is one of the schools for gifted children "Intellect": Create a game world "Minotaur's Labyrinth", in which the brave Theseus overcomes trials, meets Ariadne and receives a ball of threads from her, looks for a way out of the labyrinth, collects various flowers (narcissus, rose, hawthorn, laurel, dill, etc.) into a wreath for girl. The project implements all the previously discussed mechanics:

- "Achievement" – overcoming all the trials, passing the levels of the labyrinth (by receiving points) and receiving a reward;
- "Joint research" – solving problems of a problematic nature: to do a "puzzle", to decipher the rebus;
- "Restraining factors" – when moving, it is necessary to take into account that the Minotaur is hiding in the labyrinth. Violation of the boundaries of the labyrinth, collision with the wall, wrong decision - and the player will meet the monster;
- "One time fun – always fun" – the right decision, completing tasks are seen as an opportunity to get a flower for beautiful Ariadne;
- "User progress" – the content of each task, the plot of the game allows to check the previously acquired knowledge, formed skills.

4.3. Experimental assessment

4.3.1. The ascertaining stage of the experiment

Specially designed control and measuring materials were used to assess the input conditions. The tasks were formulated according to the following principles:

- quality of knowledge in pedagogy and psychology, theory and technology of work with gifted children;
- understanding of international and Russian trends in the digitalization of education;
- ideas about the didactic potential of gaming technologies, pedagogy of the game;
- information search, analysis and ability to argue one's position;

- mastering digital services in educational, cognitive, professional activities.

Task examples.

Task 1 (knowledge of gamification terms, relevant techniques and methods, game elements, rules and algorithms). For example, give options for rewards, punishments to stimulate the player. Or, from the proposed list of scientists mark those who used game techniques in teaching. The student could get maximum 3 points.

Task 2 (fundamentals of informatization of education, possibilities of software tools for upbringing and development of the individual, personalization of learning by means of information technology). For example, list functions and options for using digital technologies in pedagogical assessment at the stage of reflection. The maximum score is 3 points.

Task 3 (application of software for gamification in professional activities when working with gifted children). For example, develop a quiz (to test knowledge in a playful way) and describe the methodology for working with it. The student could receive maximum 5 points.

Task 4 (analysis, reasoning and independence of judgments). For example, imagine that you are a novice game master and organizer of work, including with learners who have special educational needs. It is necessary to choose a software tool that every student in the class could master and apply to visualize their project activities (MS PowerPoint, NearPad, Prezi). Justify your choice (orally, in writing, in electronic form). The score is maximum 5 points.

So, as a result of the initial diagnosis, each master's degree student scored from 0 to 16 points. Based on the measurement results, the quality of training of future experts who work with gifted children was determined.

Thus, it was possible to collect data on 44 master's degree students, from which the experimental and control groups were formed (22 people in each). The experimental group consisted of 50 % women and 50 % men.

4.3.2. Forming stage of the experiment

This stage of the experiment was devoted to determining the structure of the course "Development and application of computer games in education". The educational needs and technical possibilities of potential practice bases were analyzed. In particular, it was revealed that the Vyatka Humanitarian Gymnasium plans to actively use game elements in the study of foreign languages. School for gifted children "Leonardo" (Oryol) plans to use it for attracting master's degree students to conduct trainings on self-determination and webinars on intercultural communication. The regional school for gifted children "Intellect" (the Oryol region) is focused on holding game events for formation of emotional intelligence, development of creative abilities, stress management, attention and concentration management.

The methods for determining the level: 0 to 6 points (inclusive) – "low", from 7 to 12 points (inclusive) – "average" and in all other cases – "high".

Master's degree students of the control group did I and II stages of the course "Development and application of computer games in education" in the same way as the experimental one. However, the study of digital services for the pedagogical activity, the functionality of the Kodu Game Lab constructor, internship, participation in master classes, competitions did not imply the purposeful inclusion of game mechanics in professional training.

4.3. 3. Control stage of the experiment

To check the compliance of the level of training of the future expert who work with gifted children with the requirements of the professional environment in which he/she will work, the test was carried out. As a result of the diagnostics each master's degree student scored from 0 to 16 points.

The number of tasks, principles of their compilation and evaluation are described earlier. Information about the results of testing the quality of training of teachers who work with gifted children before and after the experiment is presented in Table 1.

The following hypotheses were accepted:

- H0: the level of training of teachers who work with gifted children in the experimental group is statistically equal to the level of teachers in the control group;
- H1: the level in the experimental group is higher than the level of the control group.

Table 1. The results of the level of preparation of master's degree students

Level	Groups			
	Experimental group (22 master's degree students)		Control group (22 master's degree students)	
	Before the experiment	After the experiment	Before the experiment	After the experiment
High	2	7	3	4
Average	5	12	5	7
Low	15	3	14	11

In the online resource (http://medstatistic.ru/calculators/calchit.html) the values of the criterion were calculated before ($\chi 2obs.1$) and after ($\chi 2obs.2$) the experiment. For $\alpha = 0.05$, according to the distribution tables, $\chi 2crit$ is equal to 5.99. Thus, we get: $\chi 2obs.1 < \chi 2crit$ ($0.23 < 5.99$), and $\chi 2obs.2 > \chi 2crit$ ($6.71 > 5.99$).

Therefore, the shift towards improving the quality of professional training of future experts who work with gifted children can be considered not accidental.

5. Limitations

The selection of master's degree students was not random: the experimental and control groups were formed in such a way that each group was guaranteed to have the same knowledge and skills that form the basis of the professional competences of the teacher who work with gifted children.

In the course of diagnostics the results of the input control test were taken into account. The selection of participants for the experiment and the sample size are justified by the specifics of the study, the correspondence of the practice base (its divisions) to the the specialization of the training program; availability of modern materials and technical base for providing effective gamification of education. In addition, the use of game mechanics, development of games for educational purposes is included in the training program for a limited number of specialties.

Throughout the experiment practical activities on using game mechanics in the professional training of future teachers who work with gifted children were carried out by the same teacher, on the same software equipment, in special classrooms.

The implementation took into account the basic principles and stages of developing an educational project, functionality of software services and platforms that have didactic potential for gamification of learning, including for learners with special educational needs.

6. Discussion

The study made it possible to clarify the didactic potential of gaming technologies for designing individual and collaborative activities of students (both master's degree students and gifted children):

- activation of cognitive interest;
- strengthening of interdisciplinary connections (history, literature, informatics, physics, etc.);
- development of demanded personality traits (diligence, desire for self-development and self-improvement, resourcefulness, organization, etc.);
- formation of communication skills (in interpersonal communication and group work).

Performing the qualitative assessment of the results of the control test, we note that 32 % of the master's degree students of the experimental group had a high level of preparation for the requirements of the future professional environment. Initially, this percentage was equal to 9 %. The share of students whose quality of future professional training was initially defined as "low" qualitatively decreased from 68 % to 14 %. In the control group the changes are less significant. For example, the proportion of students who have high level increased by 4 % (from 14 % to 18 %), low level decreased from 64 % to 50 %.

Of course, restrictions for applying game mechanics were formulated. For example, when teaching master's degree students: compliance with the training program, field of professional

activity and features of functioning of the practice base. When working with gifted children: discussion of used game forms with the administration of the school (center), parents, taking into account individual and psychological and physiological needs of students.

The research materials correspond to the priority areas of the activity of UNESCO and OECD, Erasmus Mundus, centers for supporting creativity and talents in terms of gamification of education, including for learners with special educational needs (17 Goals to Transform Our World, 2022).

The obtained results correspond to the conclusions of N. V. Makarova about the potential of didactic games for higher education (Makarova, 2021) and develop the ideas of P. Lameras et al. regarding the influence of game strategy, mechanics, dynamics on the quality of education (Lameras et al., 2021). The proposed version of gamification can be part of E. V. Shmeleva's holistic model of working with gifted children in the digital environment (Shmeleva, 2018).

7. Conclusion

Work with gifted children assumes that the digital school mentor will be able to show flexibility of thinking, creativity, professional skills, and the ability to apply innovative pedagogical technologies. The complexity of implementation of these areas of activity is determined by the presence of a wide range of problems in teaching learners with special educational needs: the complexity of diagnosing giftedness (talent), the choice of methods and means of development, the difficulties of socializing gifted children in a peer group, etc.

Innovative pedagogical technologies (gamification, m-learning, flipped classroom, etc.) enrich didactic tools of the teacher, provide additional opportunities for both organizing individual and joint work. Obtaining theoretical knowledge on gaming technologies, developing skills in working with digital services for gamification of work with gifted children, experience in participating in competitions and festivals for presenting/self-presenting gaming educational solutions is an important stage in the professional training of master's degree students of the training program 44.04.01 Pedagogical education. Pedagogy of giftedness (Federal'nyj gosudarstvennyj obrazovatel'nyj...).

The significance of the present study lies in the following:

– the possibility and expediency of using game mechanics in the preparation of master's degree students, future experts who work with gifted children, is substantiated;

– a variant of integration of game mechanics into educational, design, research and educational and entertainment activities of learners, including those with special educational needs, is presented.

When discussing the results of the experiment and clarifying the didactic potential of gamification, relevant digital services for professional training of master's degree students, it was found that the described system of actions has real possibilities for:

- improving the quality of knowledge in pedagogy and psychology, theory and technology of work with gifted children;
- enrichment of the methodological complex for identification of giftedness at different age stages;
- development of own educational solutions on problems of digitalization;
- development of information and communication literacy skills.

Possible directions for improving the presented option of including game mechanics in educational, design, research and practical activities of master's degree students, future experts who work with gifted children may be the following:

1. Consider game mechanics not only for reward (positive motivation), but also for punishment. For example: "Non-reward" (the player who breaks the most devices/instruments during the study does not receive points), or "Quarantine" (the player who most often violates rules of network interaction or interpersonal communication is temporarily isolated).

2. Apply game mechanics in related disciplines of the master's program. For example, "Organization of educational start-up projects".

3. More actively present results of game solutions at festivals of pedagogical skills or competitions for gifted children.

Of course, the use of game elements in non-game contexts will require additional labor, time, and financial resources from both the teacher of higher education institution and the master's

degree students, however, positive emotions after winning a game, competition, festival significantly contribute to intensification of professional development.

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