

Plot-Didactic Game System Design in the Formation of a Digital Footprint in Preschool Children Career Guidance Based on Gamification

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ABSTRACT

The article considers theoretical approaches to introducing preschoolers to adult work and analyses the concept and technologies of preschool career guidance. It proves the effectiveness of gamification in preschool children career guidance as a modern trend of involving children in educational process through the game. The system of plot-didactic games in the format of computer games, developed on the basis of the principles of contextuality, motivation, gradual meaningful complication and differentiation, has become a substantive foundation for digital footprint forming process in preschool children career guidance through gamification tools. Auto control used as the main gamification mechanism, includes the following sequential steps: involvement (motivation) - feedback - meeting the needs - a new system of goals - moving to a new level of professional self-determination. The article also describes the algorithm and the model of the digital space content of preschool career guidance, and presents the results of the plot-didactic games testing at the diagnostic stage.

Keywords: *gamification, preschooler career guidance, plot-didactic game, digital footprint*

1. INTRODUCTION

The subjects of career guidance at the present stage are the children of the "digital generation". It is the generation that will have to master the trend areas of human professional activity in all spheres of their lives in the near future. The analysis of prevailing models of career guidance for preschoolers revealed a discrepancy between the content and forms of career guidance with the characteristics of the digital space for children development as well as with the state social demand for the education system to solve the strategic task to design career self-determination of the younger generation as a basis for socially useful activities of advanced digital technological development.

1.1. Theoretical background

1.1.1 Theoretical approaches to introducing preschool children to adult labor

A comparative analysis of the tasks of preschool career guidance, made in the works of Russian scientists in preschool education [3, 4, 12, 22], allows making a conclusion that introducing children to adult work is an integral part of labor education at preschool age.

Russian scientists' researches present different approaches to introducing preschool children to adult labor. M.V.

Krulekhti, V.I. Loginova focus on building children's understanding of the labor content, on the products that the representatives of various professions produce, on making preschool children feel respect for work [12, 22].

S.A. Kozlova, A. Sh. Shakhmanov believe that the priority task is to introduce preschoolers to the working man image, to his attitude to work, as well as developing the ideas that a profession appears in response to the needs of people (a doctor treats patients, a teacher teaches people). [18, 7].

1.1.2 Early preschool career guidance

Many modern studies emphasize the need to modernize traditional approaches to labor education, due, firstly, to an increasing degree of technologization of all spheres of human activity, and secondly, to economic development and its impact on the social life of people [1,4, 5,20,41,42.]. In this regard, the conceptual apparatus of preschool pedagogy in the field of career guidance has been enriched by the new concept of "early preschool career guidance".

N. N. Zakharov defines the tasks of career guidance for preschool children the following way: to introduce children to professions, in accordance with children's age characteristics, to teach them to love work and labor, to develop their interest to work and basic labor skills in some areas of labor activity. The purpose of early career guidance is to form a child's emotional attitude to professions, to provide preschoolers with the opportunity to use their strengths in accessible activities [14].

The research of N.N. Kolmogortseva emphasizes that in order to form an “indicative basis” for choosing a profession, first of all, it is necessary to develop ideas what personality traits a representative of some profession should possess [20].

Thus, the cognitive component of the process of early career guidance is associated with the formation of the professional component of preschoolers’ world image, which is interpreted today not only as a multi-level system of ideas about the world, other people, about themselves and their activities (A.V. Petrovsky, M.G. Yaroshevsky) [30], but also as a system of human relations to the world (E. Yu. Artemyev, L. S. Nazarova) [2].

In this case, early career guidance does not presuppose that by the end of the preschool period children should be ready only to make an informed choice of a profession, but they also should possess a cognitive interest and a system of knowledge, ideas about the diversity and objective specificity of professions .

Assessing the potential for including preschool children in the process of early career guidance, the appropriateness and necessity of such work, it should be noted that its most important result will be the development of characteristics of social adaptability of children, as well as socially significant qualities: responsibility, social activity, communication, independence, contributing to the success of their future social activities [3.39].

1.1.3 Technologies of early preschool career guidance

Preschoolers' ideas about labor and professions must be developed taking into account modern educational technologies. The most effective ones in career guidance are the following:

- project technology (L. S. Kiseleva, T. A. Danilina, T. S. Lagoda, M. B. Zuykova and others) [31.33];
- research technology (A.I. Savenkov, T.A. Korotkova, etc.) [21, 34];
- pedagogical role-playing game technology (D. B. Elkonin, A. V. Zaporozhets, R. I. Zhukovskaya, D. V. Menzheritskaya, A. P. Usova, S. L. Novoselova, N. Ya. Mikhailenko , N.A. Korotkova and others) [9,15,23,24,25, 35, 37,39, 40];
- technology of integrated learning (L.A. Wenger, EE Kravtsova, OA Korolupova and others) [31].
- information and communication technologies [31].

The main difficulty in introducing children to professions is that a significant part of adult work is not available for direct observation. Information and communication technologies

involve modeling various professional situations that cannot be reconstructed in an educational organization. In this regard, a promising direction is to identify opportunities for the effective use of digital educational resources as an effective tool for early preschool career guidance.

1.1.4 Gamification as a learning tool

Gamification is one of the modern trends of the involvement in some activities, including educational process, through the game. According to the researches [6, 16, 17, 27, 29], gamification is the use of game elements or game principles in a non-game context. The main goal of gamification is to get a person involved in a particular process as if he were playing an entertaining game.

There are two types of gamification:

substantive - the introduction of game elements into routine processes in order to change the content of what a person is doing, to make it more playable;

structural - the use of game elements (stickers, extra points, etc.) to make it easier and more interesting for a person to cope with the content [6,10].

Gamification requires the implementation of three basic principles of the game:

- a clear representation of the goal to be achieved by the players;
- the presence of rules restricting the behavior of participants, but at the same time allowing to reach a success;
- mandatory implementation of the rules by participants [29].

K. Verbach [8] identifies three components of gamification:

- elements of the game (a set of tools that create a sense of the game: points, levels, badges, ratings, avatars, awards, missions, etc.);
- technologies for creating games (tools that organize, structure all the game elements and require practical skills of a game designer);
- non-gaming context (understood as an activity with the main purpose outside the game context).

To create game templates, you must understand the game structural components that determine its functioning. K. Vorbak, in particular, proposes to consider all the elements that make up the game to be a conditional pyramid of three layers: dynamics, mechanics, components. The pyramid of gaming components means that top-level concepts must be supported and disclosed by one or more lower-level elements.

Theoretical and applied aspects of gamification inclusion in education are given in the works of V.A. Polyakova [32], T.E. Pakhomova [29], L.P. Varenina [6], E. Klopfer [44], K. Werbach [8], Dimarchuk A.R. [11].

In preschool and primary education at the present stage, computer games have become widespread. A. A. Duminsh, L. V. Zaitseva [13] distinguish the following genres of computer games: adventure games, games based on user actions, strategic games and simulation-based games, role-playing games.

Another approach to the design of computer games is proposed by O.A. Shabalina [36]. The author believes that the key characteristic of a computer game quality should be the balance of the game and learning components. Based on the analysis performed by the author, there are four ways to organize scenarios in educational games:

- training script;
- a training script with game elements;
- independent game and training script;
- game script with learning elements.

Each of these scripts can be used to design educational games, but for the greatest training effectiveness, the author suggests using a combined script model. That is, game and training tasks will be performed simultaneously, which will ensure the balance of game and learning components [36].

For computer games development, various technologies are used: programming languages, game kernels, multimedia platforms, etc. The choice of this or that technology primarily depends on the game script (2D or 3D graphics, multimedia, database, connection of 38 peripheral devices, etc.), as well as on the educational purpose of the game.

The technology for the development of computer games is presented in detail in the works of A. A. Duminsh, L. V. Zaitseva [13]. The authors compare technologies for the development of computer games, such as Flash, Java, AJAX, HTML, CSS, Unity, Silverlight, Shockwave according to the following criteria: simplicity of code; accessibility of technology; compatibility with operating systems for development; graphics support; audio support, video; incompatibility of browsers, etc.

As a result of the comparison, we can conclude that it is impossible to unequivocally name the best technology for creating computer games. The choice, first of all, depends on the availability of resources for the devices that are intended to be used (tablets, mobile devices or desktops), on the game strategy, on hardware requirements, etc.

The obvious advantages of educational computer games are that they provide various forms of information, allow repeating and accessing the same material many times, and also let children work at an individual pace. At the same time, the main disadvantage is that the effectiveness of training depends on the quality of the training system and on how well a student works with it. Modern training models are largely based on the use of various electronic teaching aids: from electronic textbooks and simulators to specialized automation systems for any activity [19, 26, 28, 38, 43, 45].

In Russia, the National Technological Initiative Olympiad is a striking example of the use of gamification in career guidance and professional self-determination of students in

the digital space. But the age of its participants is limited - the 8-11th grade students. For all other age groups of the educational process participants, traditional models of career guidance and professional self-determination are mostly used.

1.2 Our contribution

In our opinion, the use of gamification in early preschool career guidance is associated with the comprehension of theoretical aspects and the search for applied tools for the partial transfer of children's "professional" play activities into virtual space.

As a substantive basis of preschool career guidance digital footprint forming through gamification tools, we offer a system of plot-didactic games in the format of computer games. We have determined the principles for the system formation of plot-didactic games for preschool children, highlighted the requirements and substantiated the automatic control mechanism for the development of computer-based plot-didactic games for early preschool career guidance and developed an algorithm to fill in the digital space of career guidance with some meaningful content.

1.3 Article structure

The article defines the tasks and research methods, and describes the features of designing a system of plot-didactic games as a contextual basis for a digital footprint formation in preschool career guidance. The algorithm and the model of the digital space content of preschool career guidance are also described, and the results of the plot-didactic games testing at the diagnostic stage are presented.

2. RESEARCH METHODS

2.1 Research hypotheses

Hypothesis 1. The system of plot-didactic games in computer games format with the use of gamification tools is the substantive basis of the digital footprint forming process in preschool career guidance.

The system of plot-didactic games is developed on the basis of the principles of context, motivation, gradual contextual complication and differentiation.

Hypothesis 2. The main gamification mechanism in computer games development for preschool career guidance is auto control mechanism, which includes sequential steps: involvement (motivation), feedback, meeting the needs, a new system of goals, moving to a new level of professional self-determination.

Hypothesis 3.

The system of plot-didactic games includes career-oriented games for the diagnostic and indicative stages of the digital

footprint formation. The first game stage is aimed at identifying the level of the main components formation in preschool career guidance (cognitive, emotional, activity components), and at the second stage they provide some situations with professional samples. Accordingly, the digital space content of preschool career guidance simultaneously acts as a diagnostic and developing space for the preschool professional self-determination formation.

2.2 Research aims

To determine the gamification possibilities and formats of digital footprint in preschool career guidance;

To determine the principles of plot-didactic games system design as a substantive basis for the digital footprint formation in preschool career guidance;

To develop and test the algorithm for contextual filling of the digital space in preschool career guidance;

To develop the model of the digital space content in preschool career guidance.

2.3 Research methods

The following research methods were used: theoretical (theoretical analysis and synthesis, classification of the studied objects and processes, modeling); formative (career guidance plot-didactic games, career gaming mini-tests); methods for graphical presentation of the research results.

3. RESULTS

The formation of a digital footprint in preschool career guidance on the basis of gamification is a resource educational platform designed to capture the digital footprint of each participant. The platform is a set of tools that allow tracing a child's attendance of the number of career classes of the following types: "person-person", "person-nature", "person-technique", "person-sign system", "person-art image". The tools also give the opportunities to monitor and record a qualitative indicator of a child's involvement in a particular area, according to standardized assessment methods.

The platform includes a website and a mobile application for devices running Android and iOS.

As a result of using the platform, a digital footprint is formed - that is the statistics on the activities that a child chooses. Children's data is anonymously processed, only the children's identifiers are used.

The content of preschool career guidance digital footprint based on gamification is a system of plot-didactic games.

The design of the plot-didactic games content is based on several principles:

1. The principle of context:

- games are developed and systematized in accordance with five groups of professions: "man-man", "man-sign system", "man-art image", "man-technology" and "man-nature",
- the content of each game reveals the structure of labor activity (goal-motive-means-action-result),
- the main guidelines for the content development are the following: a dynamic plot, with a content line familiar for preschoolers; educational materials in various forms of presentation (video, graphics, animation, etc.), the possibility of obtaining some additional knowledge to maintain a further motivation for passing the game.

2. The principle of motivation. At the present stage, a sufficiently large amount of resources can be acquired for parents, teachers of preschool educational organizations and additional education institutions to be used for forming integral ideas about professions and careers.

In preschool educational organizations, introducing children to adult labor is a compulsory area of educational activity, which is implemented through a system of various types, forms and methods in accordance with the students age characteristics. However, it should be noted that it is not always possible to trace the process of career guidance formation and development of each child.

The electronic resource developed by us is intended to act as a tool for developing an individual career guidance route for a child, as well as a driver for maintaining the motivational component of preschool career guidance.

3. The principle of gradual content complication and differentiation. The range of professions is determined by the principle of "close-distant", that is, from the knowledge of the parents' professions or the professions that a child has a clear understanding of, to the list of careers that a child has a vague idea of. Differentiation involves introducing a child to specializations of a particular professional field and the level of a worker's qualification. For example, a doctor can be a pediatrician, otolaryngologist, surgeon, ophthalmologist, therapist, neuropathologist, etc. The level of qualification depends on education and position: a nurse, senior nurse, ambulance paramedic, doctor, department chief doctor or the head of the hospital, etc.

We consider the automatic control to be the main gamification mechanism in computer games development for preschool career guidance. It includes a certain sequence of steps: involvement (motivation) - feedback - meeting the needs - a new system of goals - moving to a new level of professional self-determination.

Based on the concretization of plot-didactic games system design principles for the digital footprint formation in preschool career guidance and the gamification tools mechanism, we have developed and tested an algorithm for contextual filling the digital space of preschool career guidance.

Stage 1 is diagnostic. It is aimed at identifying the starting level of the child's career guidance. It includes the diagnostics of:

- emotional component, which is manifested in the predominant interest in a particular group of professions or in a particular profession;
- cognitive component, which is manifested in the systematic knowledge of a particular profession;
- activity component, represented by a set of competencies that a child shows when solving certain tasks.

Diagnostic tasks are game quests in the form of plot-didactic games. The structural characteristics of plot-didactic games are focused on revealing the formation level of each career guidance component:

- a game task (solving the problem-game situation associated with professional activities) is focused on the diagnosis of the emotional component;
- rules (“regulators”, “limiters” that allow involving children in solving the game situation, applying their knowledge of the profession) are focused on the diagnosis of the cognitive component;
- game actions to solve the game problem (specific actions that child perform in a virtual content) are focused on identifying the activity component.

The systematization of game quests within the content is carried out in accordance with five groups of professions, which are presented in Table 1.

Table 1 Approximate list of professions for preschoolers, in the form of game quests at the diagnostic stage

Man-Man	Man-Sign system	Man-Nature	Man-Technology	Man-Art image
Kindergarten teacher	Programmer	Ecologist	Driver	Painter
Doctor	Accountant (economist)	Agronomist	Builder	Writer
Teacher	Lawyer	Breeder	Engineer	Designer
Trainer	Librarian	Veterinarian	Seamstress	Actor
Seller	Air traffic controller	Florist	Fashion Designer	Musician
Beauty parlor stylists (hairdresser, lashmaker, manicurist, cosmetologist, etc.)	Pharmacist	Dog handler	Military	
			Electric locomotive driver	
			Firefighter	

The determination of the children's professional interests is carried out according to the indicators, each indicator is evaluated in points:

1. *Being initiative: the theme and / or content of the game is offered by the teacher - 0/1; a child chooses the theme and / or content of the game on his own - 2.*

The time spent in the game content (duration): minimum (shortly up to 5 minutes) - 1, average (from 7 to 15 minutes) - 2, maximum (from 15 to 25 minutes) - 3.

Frequency of access to game content: rarely (1-2 times a month) - 1, often (4 times a month) - 2, very often (2-3 times a week) - 3.

The result of the game: no result - 0, getting a result - 1.

Stage 1 - analytical. It involves generalization of the result recorded by the content administrator and provided to parents and / or teachers using this electronic content.

Stage 2 - indicative. Career guidance in preschool educational institutions and institutions of further education develops all three components of the initial career interest. However, the main educational emphasis is on the cognitive component, that is, on introducing children to professions. For the formation and development of initial professional self-determination, it is necessary to immerse children in the game situation with career samples. Of course, career-oriented forms of work organized by teachers in a preschool educational organization allow children to apply knowledge of a particular profession in role-playing games, but the format of a creative game does not imply career development, as the teacher cannot dictate the plot and indicate options for children's actions.

Preschoolers' immersion in plot-didactic career guidance computer games, the main component of which is the rule, allows not only to control, but also to record the digital footprint of children. It must be emphasized that the digital footprint is recorded at three levels: cognitive, emotional and behavioral.

The list of games, which is the foundation for plot-didactic game system design as a contextual basis for the digital footprint forming process of preschool career guidance, is based on the general requirements for constructing the preschool education content and can be adjusted taking into account a regional component.

Solving game tasks in digital content, children may encounter a lack of knowledge about a particular profession. In this case, to achieve the result, preschoolers, parents and teachers can be offered tips in the form of links to existing educational resources. An adult can determine what content to choose for the work with the children so that they can solve the game task.

The model of the digital space content of career guidance is presented in Fig. 1.

Model of digital space content in preschool career guidance

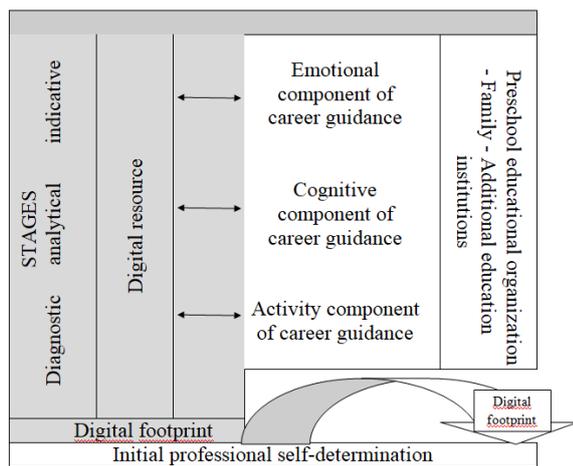


Figure 1 Model of digital space content preschool career guidane

We will illustrate the filling of digital space content using the example of a group of professions "man-man".

Cognitive component: completing tasks in pictures (voiced by clicking on the symbol, for children who can't read) in accordance with the choice of the doctor's place of work, uniforms, tools and actions.

Emotional component: children select the signs that characterize their attitude to the profession and the content of the activity: positive, neutral, negative.

The activity component is evaluated by the results of the children's game quest passing, the content of which is associated with the doctor's activities.

The game mechanics may involve choosing the right answer from the proposed ones or establishing a sequence of actions.

Auto control mechanism:

- involvement (motivation) - animated situation of a child's illness, asking for help, modeling the doctor's and the parents' actions (calling a doctor, the doctor's arrival, preparing for medical tests, sequential examination, prescription of drugs, friendly interaction with the child and parents, parents' going to the pharmacy, parents' giving the child medicine - the child's recovery). By analogy the situation may be: visiting a clinic, calling an ambulance and hospitalizing a child, helping a child on the street, if the doctor is nearby; differentiation is by the doctor's specialization or position;
- feedback - thanks for help in the form of tokens and the transition to another level;
- meeting the needs - meeting cognitive needs, increase of self-esteem, development of a motive for achieving success;
- a new system of goals - learn doctors' specializations;
- moving to a new level of professional self-determination - new knowledge, skills, competencies.

Thus, the digital content developed by us, simultaneously serves as a diagnostic and developing space for the initial professional self-determination formation of a preschool child.

4. RESULTS AND DISCUSSION

1. The main gamification format in determining the digital footprint in preschool career guidance is determined by a plot-didactic game.

2. The principles of context, motivation, gradual complication and differentiation act as the basis for a plot-didactic games system designing as a contextual basis for the formation of a digital footprint in preschool career guidance.

3. The algorithm of the digital space content filling in preschool career guidance includes diagnostic, analytical and indicative stages.

4. The model of the digital space content of preschool career guidance integrates the resources of educational organizations, families and digital content.

The approbation of plot-didactic games at the diagnostic stage of the content-filling algorithm for the digital space of preschool career guidance was carried out as an experiment with 42 children as participants.

The first digital footprint, reflecting the initial preschool children's professional interest as a part of the diagnostic stage, allows ascertaining gender differentiation: girls prefer a group of professions "man-man" and "man-art

image”, boys choose the group of professions “man-technique”, “man-sign system”. Only a few children, regardless of their gender, chose the group of professions “man-nature”.

It should be noted that children demonstrate a sufficient level of general knowledge about professions, while completing game quests, preschoolers experienced difficulties in completing tasks related to determining the functional depending on the specialization and position held by a representative of a particular profession. These features will be taken into account in the development of plot-didactic games for the indicative stage.

5. CONCLUSION

The authors substantiated the use of gamification in preschool career guidance through the game, highlighted the features of the plot-didactic games system designing when forming a digital footprint in preschool career guidance based on gamification, described the algorithm and model of the digital space content of preschool career guidance, presented the results of testing plot-didactic games at the diagnostic stage developed by the algorithm. This article has been written with the financial support of the Russian Foundation for Basic Research as part of a research project “Gamification of the digital footprint as a model of modern career guidance and professional self-determination of children of different age groups in the continuing education system” (No. 19-29-07313MK).

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