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PRESS

Adaptation to School for Children with Health Limitations with the Use of the Application "Electronic Tutor"

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ABSTRACT
A child with health limitations (HL) needs specialized methodological products to help him adapt to school. These products will be effective if their device, content, design maximally take into account mental capabilities, perception, and behavior scenarios of a child. The "Electronic Tutor" application designed by the authors on the basis of the human-centered design (HCD) principles and taking into account the specifics of the tutor's work is one of the tools for adapting children with health limitations to school. The article presents the conceptual foundations of creating the application, substantiates the feasibility of its main elements, analyzes the features of similar developments, presents the results of testing the application, shows the possibility of its use by children without health limitations. The IT component of the project is not presented in the article due to the fact that it has independent meaning and tasks. The conclusion is made that it is necessary to expand the circle of applications of this kind, taking into account the characteristics of various categories of children.
Keywords: health limitations, inclusive education, adaptation to school, teaching materials, electronic application, tutor

1. INTRODUCTION

Inclusive education is actively developing in the 2010s in Russia, in which children with learning disabilities are included in the general educational process [1; 2; 4; 5]. Special conditions for teaching are created in schools for this, from the design and content of lessons to special professional actions to adapt the interior and environment [12].

Inclusive education is aimed at the achievement of equal rights for those who receive it, activation of their interaction, development of new communication skills, including in overcoming difficulties or differences that exist between pupils. First of all, it involves overcoming any artificial separation of people with different abilities, age, level of training, etc. The principles of inclusive education encourage specialists to search for forms of learning that will help different children to be together and cooperate, as opposed to becoming familiar isolation of educational organizations that implement adapted basic general education programs for people with HL [14].

The Ministry of Education of the Russian Federation considers it appropriate to introduce additional rates for teachers and medical workers in the staffing list of educational organizations in order to ensure the full development of educational programs for children with

HL, as well as to correct their disabilities [10]. In this case, a special problem is the provision of each child, who is recommended tutorial support, with a personal tutor. The need of introducing such staff unit "for every 1-6 students with HL" is determined in accordance with the Order of the Ministry of Education [10], but practice shows that children often can be in different classes and even school buildings, and one tutor cannot provide permanent accompaniment to all the children.

The tutor helps organize the activities of children with HL within the framework of the general lesson/lesson scheme, and, if necessary, provides individual assistance to the child. Tutoring becomes an element of a child-oriented support system in an inclusive educational organization [6; 9; 16].

In a situation where it is not possible to provide each child with a personal tutor, the problem can be partially resolved through the use of the "Electronic Tutor" application for a tablet or smartphone. The application was developed and implemented by the employees of the Federal State Autonomous Educational Institution of Higher Education "Ural Federal University" by order of the State Budgetary Institution of the Sverdlovsk Region of the Center for Psychological, Pedagogical, Medical and Social Assistance "Resource" and with financial support from the Ministry of Education and Youth Policy of the Sverdlovsk Region. The application can be used at the stage of

preparation for school in order to provide comprehensive information about the educational process, new people, new activities.

The subject of the study in this article is the assessment of the compliance of the main application parameters with the tasks of adapting a child with HL to learning in an inclusive school. The authors in their design proceeded from two main points: the parallelism of the competencies of "real" and electronic tutors; the productivity of human-centered design installations to the project characteristics.

2. METHODOLOGY OF THE STUDY

The analysis of a complex electronic methodological product that adapts a child with HL to school includes support for an interdisciplinary methodology, as well as the study of fundamental work in each individual branch of knowledge. In our case, these are pedagogy and psychology of inclusive education; age and personality psychology; communication theory; graphic design theory, and the HCD concept.

Accordingly, the work of representatives of the activity approach is the main and most significant in the field of pedagogy for this study: G. S. Batishcheva, V. S. Vygotskiy, A. N. Leontyev, S. L. Rubinstein, D. B. Elkonin, their followers (I. A. Zimnyaya, G. P. Zinchenko, Yu. F. Kuznetsov, G. A. Tsukerman et al.), who build a triad of "active subject – goal setting – interaction with the object", the educational process in which is accomplished thanks to the joint efforts of a child and an adult (in our case, objectifying knowledge and position in an electronic application format).

The cognitive approach was used in order to determine the features of the perception of the application material by a child with HL in addition to the included observation (B. M. Velichkovskiy, V. A. Lectorskiy) and works on gestalt psychology (R. Solso, H. Shiffman et al.). Clarification of the scenarios for information perception from an electronic device required an appeal to work giving recommendations on how to activate a person with a storage medium. Back in the 1930s psychologists E. Tolman, F. Bartlett studied the processes of memorization, developed the notions of"cognitive map", "cognitive model" and "installation", proving the need for the meaningfulness of the process of memorization, development of the attitude of the subject to the content of the memorized issue. In the future, including in connection with issues of human interaction with technical devices and interface design, these issues were rised by A. Cooper (2009) [7]; M. Mandel (2005); D. A. Norman (1972, 1977); D. Rumelhart (1986), R. Shenk (2010) et al. Among all versions of user-interface interaction, the human-centered concept was chosen [18; 21] as the most appropriate model of active learning.

3. DESIGN PRINCIPLES OF THE APPLICATION "ELECTRONIC TUTOR"

The specific aspects of the work of a tutor specialist are defined in the job description, which is independently developed by the educational organization on the basis of the professional standard "Specialist in the field of education." The tutor creates the conditions for individualizing the learning process – for example, drawing up individual curricula with the teacher and planning individual educational trajectories. He organizes the interaction of the child with teachers and other teaching staff [11; 15]. The escort teacher should be ready for such types of professional activity as educational, correctional, and pedagogical [19], diagnostic and advisory [13], preventive, organizational, and managerial [8; 20], cultural and educational [3; 17].

Tutor needs pedagogical education, good theoretical training and practical skills [9].

We took these characteristics as the basis of the electronic tutor model and identified such features as:

– the balance of more or less active periods of perception of visual and textual material to maintain user attention;
– maximum consideration of the mental and psychological characteristics of users;
– general tarnish, lack of showiness, calm visual and audio intonations of the application (including in order to avoid overload);
– the presence of different modes of operation, avoiding directives and dictates;
– the choice of a guide character that psychologically facilitates the development of locations and promotes emotionalization in the study of material;
– interaction, the inclusion of the child in, at least minimal, actions for the development and personalization of the application.

4. RESEARCH RESULTS

The mobile application "Electronic Tutor" is available on devices with operating system Google Android. You can use Google Play Market or QR code to download and install it. When creating the application logo, an attempt was made to give it the most friendly and attractive look. The designed snail image appears on the phone's display when the application is downloaded (Figure 1). The choice of a biomorphic and lively image is not accidental; it immediately corresponds to two paradigms of modern design that overcome the traditional technocratism of projects for children – sustainable and human-centered design. The color scheme activates the attention of the child, but does not tire him.
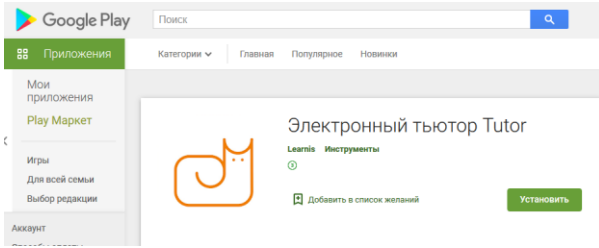
**Figure 1** The first user contact with the application "Electronic Tutor"

4.1. Interface Design

The main screen of the application allows the user to choose a location, get acquainted with brief instructions, and make setting. The purpose of the main controls for the application makes intuitive sense, and their placement on the screen automatically adjusts to the device (Figure 2). The introduction in the pop-up window on a first-name basis is justified by the age of the majority of users. The simplicity of the images continues the logic of the logo.
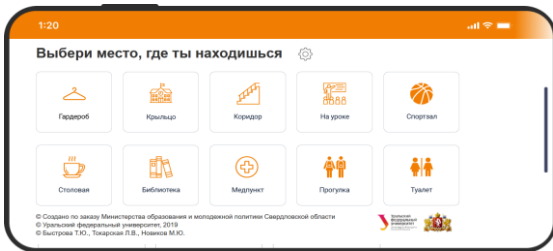
Figure 2 The interface of the application "Electronic Tutor", developed on the basis of the human-centered design principles

Selecting one of the locations, the user sees the window displaying the characteristic objects of this room. For example, after selecting "Checkroom", the user will see a room in which there is a checkroom worker, outerwear, hooks for it, etc. (Figure 3).
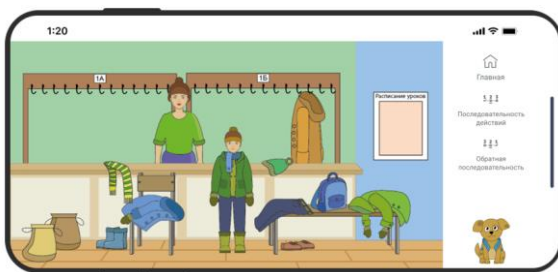
Figure 3 Location "Checkroom." Application "Electronic Tutor"

The menu on the right allows to return to the main screen, select the Object Information Mode, or the Actions Sequence Mode in a specific place (locker room in the gym, doctor's office, dining hall, etc.).

"Object Information Mode" allows to learn about the purpose of the objects displayed on the screen. When you click on the object, a window with a text prompt appears briefly describing the object and its function. For example, in the "Checkroom" location, when you click on the place where the checkroom worker is standing, the following prompt appears (Figure 4):
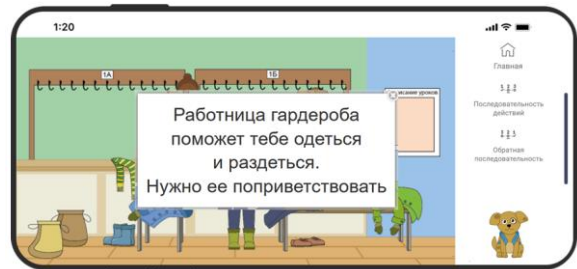
Figure 4 Pop-up window with explanatory text. Location "Checkroom." Application "Electronic Tutor"

If the child can't read, or the content of the phrase is too difficult for him, the tutor can read it out aloud. In addition, the application provides for the possibility of voicing some "communicative" phrases, as a rule, first-person greetings – on behalf of the child.

The Actions Sequence Mode allows the user to learn about the order of interaction with objects presented in the room to solve an educational or social task. Numbers appear in this mode on the location in accordance with the generally accepted algorithm of actions in this room (Figure 5).
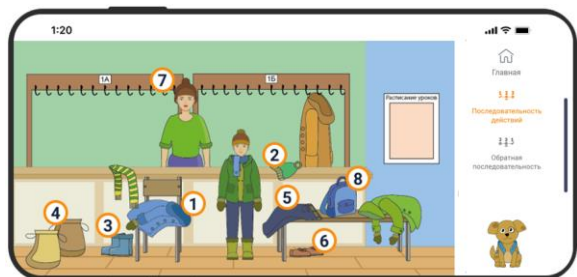
Figure 5 Action order of the user. Location "Checkroom." Application "Electronic Tutor"

The sequential execution of these actions helps the user navigate the room and solve a specific task. In a number of locations, the reverse mode of actions is also provided, for example, in a situation where the child needs to tell not only what actions to do in the checkroom when he comes to school, but also when leaving it when you need to wear clothes.

Personalization of the application is a condition for increasing its effectiveness.

One of the main conditions for a person-centered design is the personalization of a technical device and its aesthetic-functional "shell" for the needs and tastes of the user. There is a button for transition to settings on the main screen of the application to implement this requirement. The user can enter his name, select a gender, set a personal code received from the teacher, select a character (Figure 6).
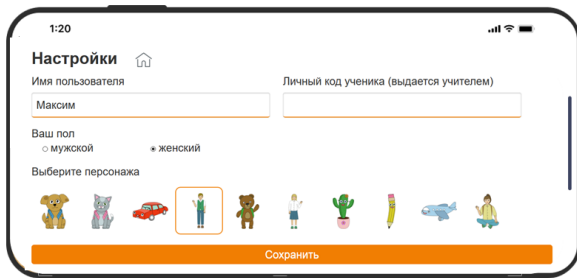
Figure 6. Personalization Settings. Application "Electronic Tutor"

Locations are generated taking into account the specified gender. For example, if a female is selected, then when you click on the location "Toilet", a picture of the toilet for girls opens.

The character selected in the settings menu accompanies the child at all locations, enhances memorability by creating positive emotions.

Personalization can also occur in the process of completing tasks from the teacher. Tasks can be downloaded in any format, then you need to register on the Learnis.ru platform (http://www.Learnis.ru) accompanying the project and go to the tasks download page by link or via a QR code. After that, enter the name of the student and download the task. If users enter the number in the application settings, they will be able to receive the task prepared by the teacher through the button "Task from the teacher" in the location "At the lesson".

4.2. Analysis of the functional characteristics of similar applications

At the pre-design stage, other mobile applications designed for children with HL were analyzed.
1) *Language and Cognitive Therapy (MITA)* – it is an application for children with autism spectrum disorders (ASD), mental retardation, and learning difficulties. The application contains vibrant interactive puzzles that are designed to help children learn how to mentally combine several objects; in the future, this may lead to an optimization of the learning process. Classes with MITA help to develop an understanding of the language, complex sentences, thinking, attention, and visual-spatial skills.

Distinguishing functional features of the Electronic Tutor Application and MITA Application:
- The Electronic Tutor Application is not intended to develop skills in comparing objects (in color, size, etc.), but to help orientate in school spaces and activities;
- in the Electronic Tutor Application, the task is downloaded by parents or a teacher who can choose it based on the individual educational needs of the child-user.

2) *Speak Silently: autism ICP* – this application is designed to facilitate communication both with non-speaking children with ASD, mental retardation, alalia, etc. and with adults with aphasia. The application allows you to upload the necessary photos or pictures, as well as voice them. The child needs to choose a picture from the two offered.
Distinguishing features of applications:
- differences in purpose and target audiences;
- the Electronic Tutor Application contains ready-made images of objects of the school territory and a description of the features of working with them, whereas analogue does not have such content.

3) *Autism Help* – this is an application for parents of children with ASD, which helps the child to meet his daily needs, such as: take a shower, drink water, understand objects and follow basic instructions to complete tasks. The application has audio and video options.
Functional differences of applications:
- purposes of applications;
- The Electronic Tutor Application has a Russified interface, and the analog uses only English.

The analysis of the products intended for children with HL made it possible to see that currently there are not enough projects with the necessary functional content to help children with HL to adapt to school.

5. DISCUSSION OF STUDY RESULTS

Testing the Electronic Tutor Application was held in:
1. Interdisciplinary Center for Applied Behavior Analysis, the Institute of Medicine and Psychology named after V. Zelman, Novosibirsk National Research State University;
2. The State Budgetary General Educational Institution of the Sverdlovsk Region implementing adapted basic general educational programs, "The Center for Psychological, Medical and Social Support "Speech Center" (SBGE SR "Speech Center"), on the basis of which the Regional Resource Center for the Development of the System for Accompanying Children with ASD on the territory of the Sverdlovsk Region;
3. Municipal Autonomous General Educational Institution – Gymnasium No. 47 of Yekaterinburg (MAGE "Gymnasium No. 47");
4. Autonomous Non-profit Organization for the Implementation of Inclusive Projects "Development without Borders";

5. State Treasury Educational Institution of the Sverdlovsk Region "Yekaterinburg School No. 4, which implements adapted basic general educational programs."

Parents, teachers, and researchers who have experience working with various categories of children with HL – mental retardation, mental deficiency, severe speech impairment, ASD, etc., acted as experts. Each expert attracted his colleagues to work with the electronic application, so, for example, the link for downloading application was posted in groups of tutors of SBGE SR "Speech Center" and MAGE "Gymnasium No. 47" in WhatsApp messenger. Thanks to this, the number of experts from several regions of the Russian Federation amounted to more than 30 people. Parents also shared the link to the application, showing a high interest in the work. Parents raising children with ASD were of particular interest in connection with the communicative difficulties their children had and the specific nature of understanding social situations.

The experience with children with disabilities of experts who participated in testing the electronic application ranged from 6 to 35 years. Experts not only tested the application but also tested the possibility of its use on children with HL. In total, more than 10 children with various manifestations of HL at the age of 5-14 years were involved in the testing process.

The testing determined the possibility of using the Electronic Tutor Application for children with HL at the stage of preparation, adaptation and training at school. At the same time, children were invited to get acquainted with all locations – classroom, corridor, dining hall, checkroom, toilet, gym, library, medical office, porch, and walk.

The experts, first of all, noted the ease of downloading the application, as well as the uniqueness of the snail symbol used to designate the application, its simplicity, and conciseness.

It is noted that the application provides an opportunity to get acquainted with all the premises of the school since often children experience organizational and behavioral difficulties in various spaces.

The possibility of using several modes was positively evaluated. It is noted that the sequential execution of actions helps the user navigate in rooms and achieve results, including thanks to the visual support of the formed behavioral chain.

Experts and teachers who took part in testing developed *recommendations for improving and developing the application* based on the testing results.

As for the list of locations, the experts had no disagreements, however, the experts had a lot of questions regarding the content of tasks and, above all, precisely on the Actions Sequence Mode. This was primarily due to the diversity of the contingent of children with HL. Even the main target group of the project – children with ASD is so diverse that it is almost impossible to find universal recommendations and phrases for instructions. So, this group includes both highly functional children with an unimpaired intellect, developed speech, experiencing difficulties in organizing communication and interaction,

and non-speaking low-functional children who demonstrate field behavior. A number of experts with experience of working with non-speaking children suggested that the phrases used in the text of the instructions are too long and require voice acting. However, experts who have experience with highly functional children indicated that the child will be able to read all the phrases.

The function "Actions Sequence Mode" canceled for a number of locations, since it is not necessary, for example, in the corridor the sequence of actions can be spontaneous. The tutor can determine the sequence or actions necessary for the child in case of difficulties with randomness.

Experts determined that the age range of potential users of the application is wide enough. Teachers of educational organizations noted separately that the application can be used in working with children who do not have developmental delays, which increases its value in terms of inclusion.

Suggestions of experts arose to change the wordings to more personal ones, expressed in the first person, for example, "I'm in school", "I'm in the checkroom", etc., however, this idea was not supported by all experts, since traditionally there are no such formulations in literature, except for special one, and they may not be familiar to the child.

It was decided after consulting with experts that if the child can read, he reads the instructions on his own, if he does not read, the tutor or parent can voice the tasks. If necessary, you must clarify the understanding of the phrase by the test person. During the training, the child will be able to independently add one or two words to the tutor's phrase.

Experts noted that the introduction of digital sequences allows the child to learn over time to independently perform actions and, in general, to capture what sequences are.

It should be noted that the application does not exclude the participation of the tutor or parent, at least in the initial stages of training. The tutor must give verbal instructions, even if the child does not respond and it seems that he does not react, at the same time, a tutor must speak slowly and it's better to speak when the child is looking at a specialist. The tutor can also determine the end or number of samples needed.

To achieve a greater effect, it is necessary to attract parents in working with the application, to complete tasks together with the child.

Experts, especially those who consider it necessary to use an applied analysis of behavior in working with children with HL, praised the possibility of social encouragement of a child by pressing the appropriate button and voicing the phrase "Well done!" addressed to the child.

The possibility of individualization of work, that is, the selection and loading of tasks, based on the characteristics of a particular child, is noted.

Experts assessed the possibility of a character significant for the child appearing at each location. As a project development prospect, the inclusion of the "download character" function is defined when the child, together

with his parents or specialists, will be able to choose a character interesting to him and upload it to the application page.

It should be noted separately that parents raising children who are recommended to study according to option 4, in accordance with the Federal State Educational Standard for Primary General Education of Children with Health Limitations (Order of the Ministry of Education and Science of the Russian Federation No. 1598 dated December 19, 2014) indicated that only a limited number of functions of the proposed application can be used in working with their children. They expressed a desire to adapt the application to the characteristics of children with severe multiple developmental disorders (TMDD).

When using the application, it is necessary to take into account the opinion of doctors and clarify the presence of contraindications, for example, convulsive readiness, etc.

Of course, the Electronic Tutor Application cannot be considered universal and corresponding to absolutely all the needs of students with HL in the context of inclusion.

The main target group of the application is children who do not have severe multiple developmental disorders and are not educated in the context of inclusion. The application can be used for intermediate certification in case of downloading the relevant tasks.

To develop the project, experts proposed the introduction of virtual and augmented reality tools in the future, expanding functionality by including more tasks, including in the form of audio files, etc. It is promising to expand the target audience by including children with severe multiple developmental disabilities by adding more voiced phrases, animated actions, etc. It is possible to include persons without developmental delays as a target group, for example, for designing individual routes for gifted children or for elderly people.

The experts also identified the possibility of including an interactive component as prospects for the development of the project, when only after performing each sequential action the button will be pressed. However, in order to avoid pressing a button without performing a preliminary action, it is necessary to have sensors or a video camera that monitor the action and give permission for the next action. In the longer term, the creation of a neural network is possible.

6. CONCLUSION

Reliance on the principles of human-centered design, pre-project, and post-project research has allowed us to develop the product necessary for the development of inclusive education. The use of the ideas of gestalt psychology as a methodological basis for the development of locations and images led to greater understandability and effectiveness of the application.

Of course, the Electronic Tutor will not allow to completely replace a person, but will make it possible to offer specially selected tasks for a child in a convenient and interesting form for him. Its most important advantage is support in the formation of an inclusive culture, where each person can find his own unique place. The main

emphasis in the use of the application should be placed on changing the attitude of the school and teacher to the student with disabilities. Mood for mutual understanding, the atmosphere of participation and cooperation, the adaptation of the environment, active contacts are the components of success.

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