Practical Activity Organization of Primary School Students with using e-Simulators

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Abstract: Ukrainian primary schools are experiencing significant changes as to Reform 'New Ukrainian School'; it reflects rapid updating of information technology and high level of children's informational activity. Nowadays education has a number of resources to support the teaching and learning for primary school students considering the fact that this school generates the foundation for student's success in the contemporary digital society. Primary schools are basically focused on development of subject knowledge and general study skills. The article deals with the practical activity organization of primary school students with using e-simulators as one of resources for developing subject knowledge and general study skills. The examples of using interactive e-simulators for young learners by teachers-to-be are demonstrated in the article. The research shows that interactive e-simulators provide real task variability, uniqueness of exercises, operative assessment of correction, adjustment of task difficulty, shade of competitiveness and game. The paper presents principles of construction of interactive authors' e-simulators: developed e-simulators should generate learners' interest; be visually presented to create pleasant emotional background; problem definition should involve learners into critical analysis of input data as to their adequacy, redundancy, relevance; e-simulators should allow learners to operate free; the principle of reliance on pedagogical and research tools of personal IT devices means the recognition of the power of modern personal IT devices and their feasibility of use in the learning process as effective and affordable tools of educational and research activities. Based on the analysis of existing experience of using e-simulators in the practice of primary education, we found that for primary school teachers it is important not only the ability to use ready-made simulators, but also the ability to create ones independently, improve them, use knowledge of tools and their functional capabilities, select and formulate tasks for young learners, assess adequately the quality of the developed e-simulators.

1 INTRODUCTION

1.1 Problem Statement

Quarantine restrictions have exacerbated the challenges facing Ukraine's educational institutions. The need for new approaches to teaching with limited number of classes remains a problem for a large part of the educational community. The solution of these issues today is impossible without large-scale introduction of e-learning tools, fundamental changes in approaches to the organization of education in educational institutions and in each discipline, in particular the role of classrooms and the effectiveness of integration of e-learning tools in school lessons (MON, 2020). Against the background of quarantine restrictions, in 2020 the Regulation on distance learning of general secondary education came into force, as well as methodological recommendations for the organization of distance learning at school. The methodical recommendations indicate that the primary level of education needs special attention, because it is the primary school that forms the child's attitude to school education, helps to take the first steps on this path, reveals their talents and natural abilities; affects the

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entire subsequent nature of the student's relationship with the learning environment and society.

The main task of the teacher, within the distance form of organization of education of young learners, is the methodical design of the educational process as a sequence of actions and experiences that students master. In some recommendations (MON, 2020) it is proposed to plan the remote work of students as a cyclical sequence of different activities (including submission of new information, training, practical exercises, etc.), and the forms of interaction should be selected depending on tasks, time and technical capabilities. However, regardless of the form of activity, the level of readiness for practical online activities among primary school students is lower than among secondary school students. There are a number of reasons for this. Let's cover them.

One group of reasons is related to objective factors – age. Thus, the processes of restructuring of mental activity, the transition from visual to verbal-logical thinking, the change of figurative and conceptual, concrete and abstract components just begin at primary school. In this perspective, practical online activities at a particular stage of learning should be feasible for each student. In addition, the distance form of organizing the education of primary school students involves the complication of the information context, the active inclusion of the child in a certain information environment, where any material is a certain interactive information (graphic, textual, associative, video information, etc.). At the same time, due to the individual way of perceiving reality, primary school students have different degrees of readiness to perceive such information online. You can also identify the following reasons:

- limited, and sometimes no experience in the use of distance learning technologies (for example, experience with virtual boards and placing completed tasks on them, etc.);
- limited experience of self-establishment by the student of mobile communication or adjustment of separate parameters of a network and, as a result, a delay in access to e-resources in real time;
- time limits that must be observed when organizing lessons using distance learning technologies. Such restrictions in the organization of practical activities narrow the range of practical skills of students, because some students require additional time, for example, for reflection, reasoning or in case of difficulties require an immediate response from the teacher, etc.;
- untimely correction when students perform practical tasks within distance learning (due to, for example, class size, technical malfunctions), which leads to a delay in the transition of the student to the next level.

The named reasons condition the need for new approaches to implementation of information and communications technologies in teaching young learners. Primary school is focused on the development subject knowledge and general study skills such as skills of writing, reading, doing sums, spelling and others, assured command of which is a prerequisite for further successful studying at school.

Achieving success in building subject and general study skills is a natural need of every young learner. Each child comes to school with an aspiration to be successful and to gain recognition of personal achievements. For a young learner the expectations of success are connected with the efforts to gain recognition on the part of people important for him/her – parents, teachers, principal, classmates and getting approval from them. Experiencing success by young learners affects the quality of education, the development of the inner child's world, the formation of self-confidence.

As we know, success is a feeling of joy, satisfaction from the fact that the result, which the personality was striving for in his work, either matches his expectations, hopes, or exceeds them. Success is always connected with actions, it is not an end in itself. This is the result of achieving the desired goal, accepted, recognized and meaningful to a child, experience of feelings of joy after overcoming difficulties. Achievement provides for getting a specific result, and recognition can be public, local or individual (Romanovsky, 2011). The success supports a child's interest in learning, encourages him/her to overcome the difficulties, urges to achieve new goals.

One of the modern ways of forming a general study and subject skills by primary students are e-simulators, which are educational software designed to shape and consolidate practical skills after preliminary mastering of theoretical data by young learners.

1.2 Recent Work

The literature also holds many studies related to the positive effects of educational use of information and communication technology (ICT) in general (Sipilä, 2014) and cloud technology in particular (Markova et al., 2019); instructional design principles, their interrelationships, overall process of designing effective teaching with ICT (Calloway, 2009; Chemerys et al., 2020), engineering design thinking, teaching and learning with ICT (Dym et al., 2005).

Some issues about primary learning were dis-

cussed such as developing technological pedagogical content knowledge in pre-service science teachers (Alayyar et al., 2012; Kovshar et al., 2019); using ICT in primary school curriculum (www.curriculumonline.ie, 2001); e-learning for primary teachers (Hughes and Daniels, 2013), using ICT in distance learning (Rahman, 2014).

We wrote some articles concerning such a significant investment in the theory as didactic potential of digital educational resources for young learners (Olefirenko, 2015; Belousova and Olefirenko, 2013); and in practice as use of GeoGebra in primary students training (Olefirenko, 2013).

1.3 Methods

Theoretical and empirical methods are used in this research. Theoretical methods (analysis and synthesis) serve to analyze opportunities, advantages and disadvantages of e-simulators as new means of practical activity organization of young learners at primary school. Empirical methods (observation, testing, pedagogical experiment) provide the experiment itself, detailed and achievement tests in order to collect data for examining the efficiency of use systematic e-simulators at primary school.

2 RESULTS

2.1 Interactive Teaching Tools in Ensuring the Success of Young Learners in Practical Activities

To educate young learners there are many e-simulators developed that facilitate the acquisition of skills in Maths, in ICT, in native language, in foreign languages, etc. However, e-simulators are relevant if it allows you to work out exactly what caused the difficulty at a particular lesson, when the specifics of teaching material is taken into account, especially the perception of young learners.

E-simulators unlike traditional manuals provide real variability of interactive tasks, uniqueness of exercises designed to form appropriate skills. In particular, for training young learners in performing calculations and doing sums, e-simulators are able to generate an unlimited number of numeric values to each task type, which allows diversifying the learning objectives, avoiding memorizing answers.

The advantage of using e-simulators during both traditional and distance learning of primary school students is to provide an opportunity to expand the possibility of presenting educational tasks aimed at primary school students – to present tasks in schematic, tabular form (figures 1, 2).

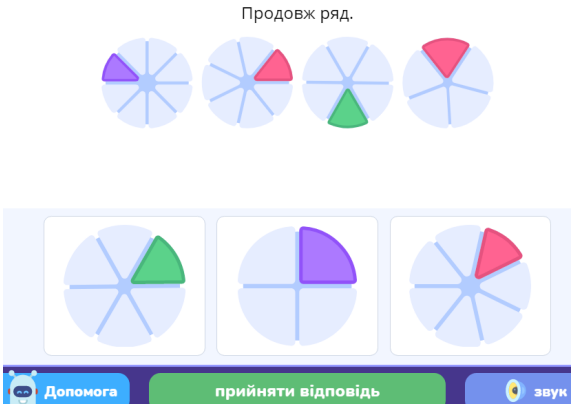

Figure 1: The task of logical load “Logiclike”.

Figure 2: Exercise for addition “Samouchka”.

An important feature is the adjustment of task difficulty (figure 3). The difficulty level can be preset designated by a teacher or selected by a learner, can have several ways of solving (each time you can increase the level of complexity of tasks, offer solutions to examples that require guesswork, intelligence (figure 4), thereby stimulating the intellectual feelings of young students).

Of particular interest there are e-simulators that implement adaptive algorithms and basing on learners’ performance of first proposed tasks adjusts automatically the level of subsequent tasks. Such adaptive interactive e-simulators are useful especially in primary school, because the difference in learners’ background, in level of their habits and skills is the most notable among children: in a class there are those who perform calculations easily, read quickly, etc., and those who are only acquainted with basic rules, learn to form syllables.

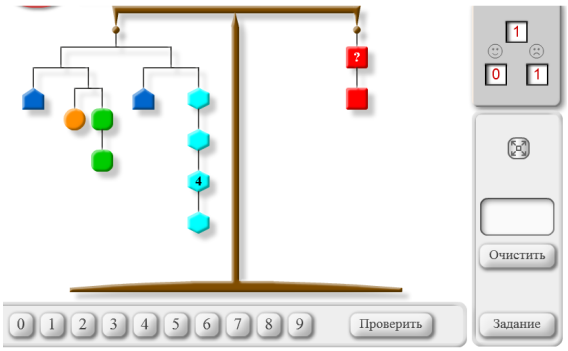

Figure 3: Scheme in “Maths-and-games”.

Figure 4: The complex of educational games “Learn”.

Automatic control of the difficulty level of tasks enables a teacher to identify gaps in learners’ knowledge and eliminate them quickly. To learners whose skills are already formed at a high level, e-simulators provide an opportunity to test their skills doing exercises of increased difficulty. Thus, tasks for each learner are in the zone of their proximal development.

E-simulators feature the ability to provide a shade of competitiveness and gaming to the exercises. It is worthy of note that game is not the main activity for primary school children, but it takes a significant place in child’s life along with educational activities. Playful learning requires substantial intellectualization of primary school child’s activities such as prompt realization of task, analysis of possible solutions, and search for the optimal variant. Moreover, the game encourages a learner to show initiatives, to develop activity, stimulates memory development, initiative thinking, releases emotions.

Using computer can realize the benefits of playful learning to the full extent. Exploring the specifics of computer games in education, there are the benefits as we know: increase learning motivation, encouragement of initiative and creative thinking, inclusion all learners into activities, getting experience of cooperation and teamwork, establishment of interdisciplinary connections, creation an informal environment for learning, favorable conditions for different strategies formation for solving problems, etc.

The emotional appeal of computer games, competitive game aspect, and variety of events, exciting plot, realistic graphics, and ability to control characters by oneself can instigate learners to achieve only a gaming purpose. Therefore, an important prerequisite for using computer games in education is to provide conversion of a gaming purpose (to help the character, to win, to release someone, to get the prize) into achieving educational goals. For example, within the electronic simulator “PilasBloques” students are asked to compile software code for a virtual hero, which will allow you to manage it (go a certain number of steps, say hello, etc. (figure 5).

Digital Mathematical Platform “Matific” contains simulators in Mathematics, focused on the organization of practical activities of students to add decimal fractions through visual models (figure 6), adding three-digit numbers and more. Playful presentation of a task, its dynamic nature, the practical purpose (to color a picture, to collect garbage, feed the cat, etc.) turns a routine work on developing skills into an interesting game that motivates learners to perform typical tasks. In addition, ability to compare the results of their own work with other learners’ ones, gives such activities as sport excitement and an incentive to improve the obtained results.

Among the advantages of using electronic simulators for the organization of practical activities of young students during both traditional and distance learning, we also single out the provision of opportunities:

- to provide systematic practical work on solving by students a large number of similar tasks in a short time (figures 7, 8);
- providing an opportunity to organize the activities of each student on its own trajectory, depending on his skills, knowledge, the need to deepen knowledge;
- providing timely assistance (which may be implicit, upon request, provided by the hero of the program, who accompanies and monitors the long delay in the exercise, etc.).

It should be noted that the peculiarity of the use of electronic simulators is the rapid assessment of student actions. Immediately after completing each task, the child may receive an appropriate reaction, which will indicate the correctness of the solution

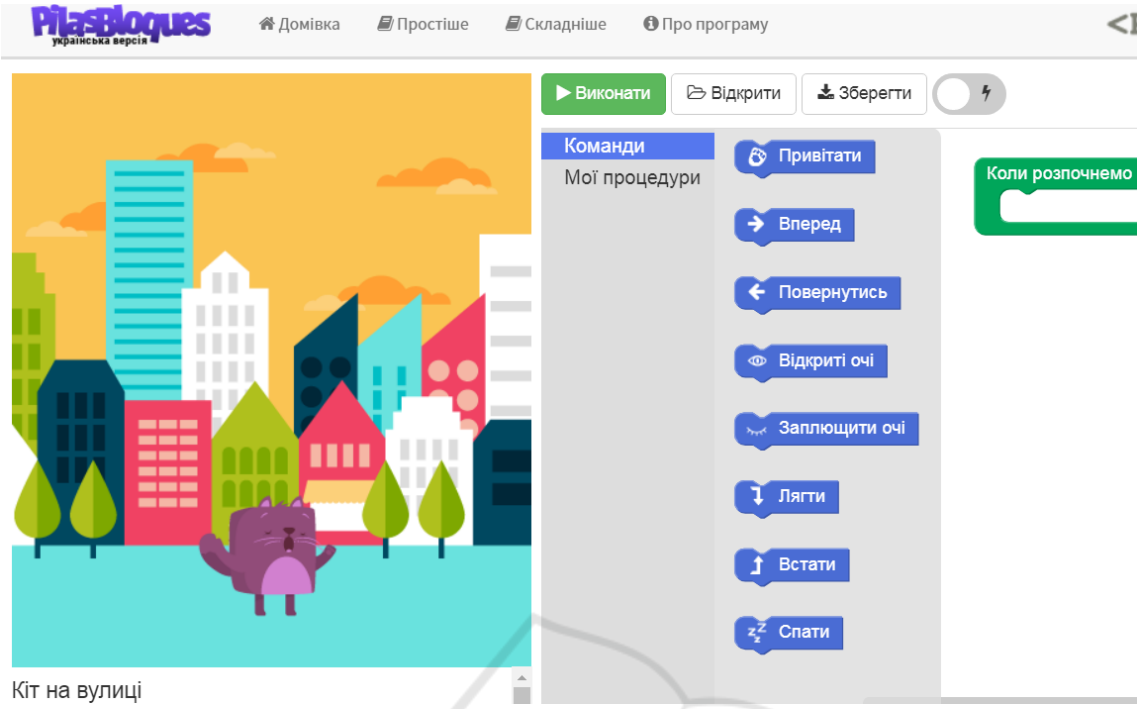

Figure 5: E-simulator “PilasBloques”.

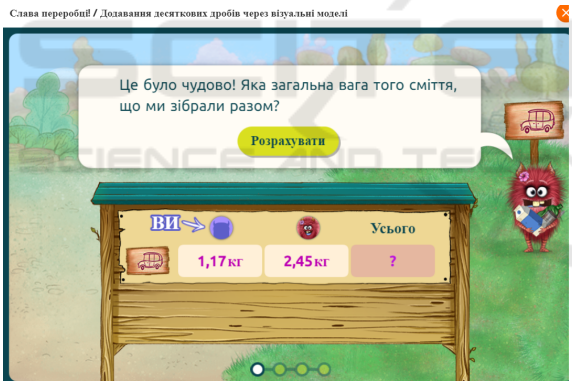

Figure 6: E-simulator “Matific”.

(figure 9). Such an immediate reaction is important when organizing the practical activities of young students with electronic simulators, because students expect approval for successful completion of tasks or some kind of support in case of errors. The immediate reaction of the electronic resource will help increase the student’s confidence in their abilities.

There are some principles of construction interactive authors’ e-simulators. With the development of tools, the availability of information sources a teacher-to-be is able to create interactive authors’ e-simulators that take into account the specifics of training learners of a particular grade on a particular topic, their individual characteristics and hardware of educational process. Authors’ e-simulators can be directed to practice exactly the skills that cause difficulties for learners.

2.2 The Principles of Construction Interactive Authors’ E-Simulators

Based on the analysis of existing experience of using e-simulators in the practice of primary education, we have identified the following principles of their construction to ensure successful teaching primary students.

The first principle to be taken into consideration at e-simulators design is the following: *developed e-simulators should generate learners’ interest*.

The matter is a child who works with an interactive model is unobtrusively involved in educational and cognitive activity. It is important to emphasize that a learner is got involved in this activity not by direct teacher’s instructions, but on his own desire to resolve the situation occurred on a computer screen. Plot design of a training material encourages him/her to educational activities. These actions require revealing subject knowledge and skills as well as the ability to apply them to a new environment. The combination of training and practical purpose that is achievable and understandable for a child gradually transforms into the learning motive. Such a transformation is promoted by the circumstance that at summarizing

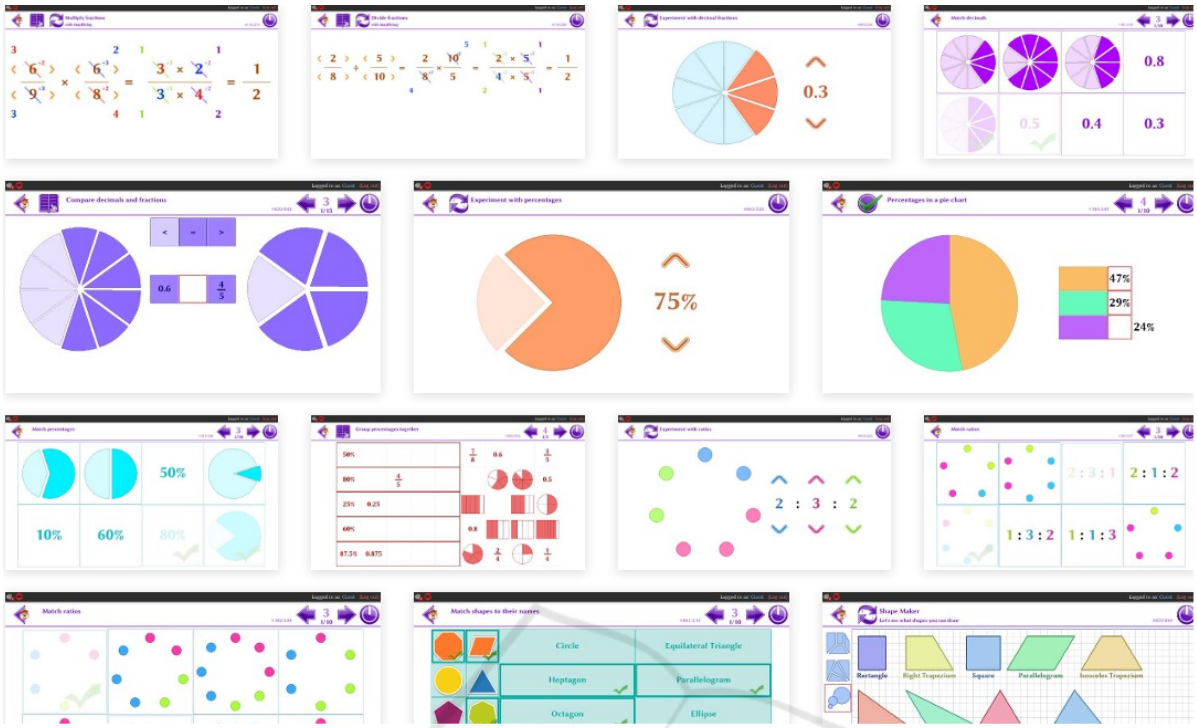

Figure 7: Simulator "Educativ".

the child's work with a didactic model, his attention is focused on the importance of the knowledge and skills that have helped to achieve a successful outcome (Belousova and Olefirenko, 2013).

In primary school it is crucial to include pure life realities into the learning content. It provides implementation of the didactic principle of training and practice connection.

E-simulators must allow to apply a learning task with all its attributes: for example, travelling cars, a chocolate bar that is being eaten, a pie which is being divided etc. A learner can move the car, divide the chocolate bar, cut the pie in different ways.

E-simulators allow to expand the diversity of training tasks, suggesting the problem having various solutions. So, a learner is assigned not only to solve the problem correctly, but also to make a rational choice of the solution method. The second principle to be taken into consideration at app design is the following: *e-simulators should be visually presented to create pleasant emotional background.*

Child's emotions at classroom activity have a significant impact on it. Emotions initiation of primary schoolchildren usually is associated with a particular situation. It might be nice visual design, familiar objects or characters, valid comments. All this calls up a learner's pleasant feelings.

Development of positive emotions and aesthetic senses is also promoted by the series of techniques. They include friendly interface of didactic interactive models, harmoniously picked up colors, using special techniques to attract and focus learner's attention, to develop his imagination, thinking, and memory. A positive emotional background of a child's learning with interactive models is also guaranteed by the possibility to cancel his actions at any moment and to return to the previous step. A learner has an opportunity to feel free doing his trials at searching right or effective task solving. He is not afraid of any negative consequences. It promotes creation of a learner's positive emotions, forming his persistence and confidence. The third principle to be taken into consideration at e-simulators design is the following: *problem definition should involve learners into critical analysis of input data as for their adequacy, redundancy, actuality*.

For this purpose, the developed e-simulators have redundant information, so that a child could choose what he/she needs. For example, additional measurements, additional data etc. The fourth principle to be taken into consideration at app design is the following: *e-simulators should allow learners to operate free, for example, to perform transformations of geometric solids (rotate, drag, resize them).*

The peculiarity of young learners' perception is a close connection with an action. For schoolchildren,

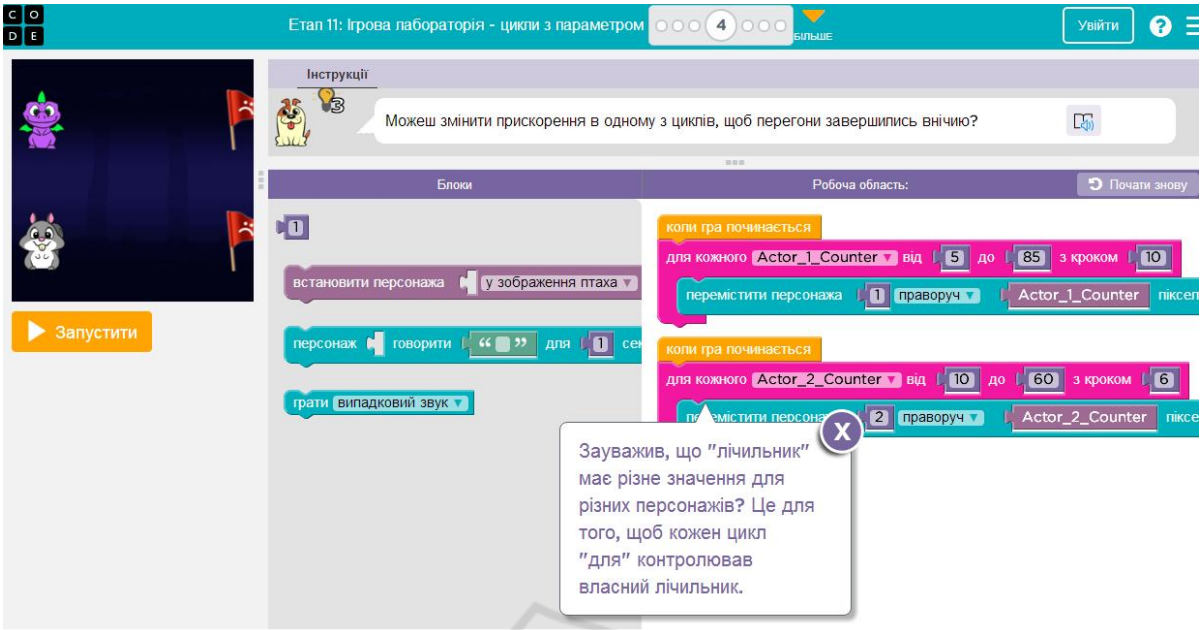

Figure 8: Simulator “Code”.

Figure 9: Tasks for 4 grade students “Learning”.

especially at the age of 6–7 years old, to perceive the subject means to do something with it, for instance, to touch, to rotate, and to change. Practical actions play a significant role for the development of child’s cognitive processes. Therefore, e-simulators should allow manipulation with learning objects.

E-simulators which are focused on learners’ research activities should provide possibility of the figures transformations such as rotation of geometric shapes, overlapping some shapes on others for their comparing and resizing. Making changes with shapes meets child’s need to experiment. At the same time it allows to see results of his activities and to make his/her own conclusions.

The fifth principle is the *principle of reliance on pedagogical and research tools of personal IT devices* means the recognition of the power of modern personal IT devices and their feasibility of use in the learning process as effective and affordable tools of educational and research activities. Note that this principle is one of the main in the further organization of the practical activities of primary students with e-simulators, because today smartphones and tablets have become an integral part of modern children’s lives. The implementation of the principle involves the use of educational mobile applications, through which the teacher has the opportunity to organize independent practical activities outside the school. To date, a powerful database of e-simulators has been developed, some of which are available on mobile applications. Such mobile simulators provide a real opportunity to organize a multi-level (individual) approach within the lesson and during the organization of distance learning, provide instant verification of the correctness of the tasks; provide opportunities to organize the practical activities of each student on their own trajectory, depending on his skills, knowledge, the need to deepen knowledge. For example, the applications “Lightbot: Code Hour” (from SpriteBox LLC), Programming for children (from IDZ Digital) are focused on supporting the topic “Performers of algorithms and their command systems” (figures 10, 11).

It should be noted that the practice of students’ knowledge gained in class is a normal process. At the

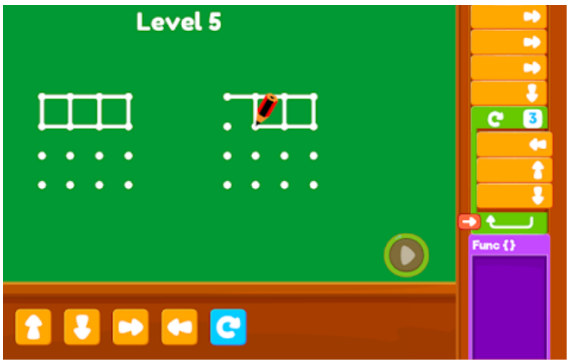

Figure 10: The complex of educational IT devices' games "Programming for children".

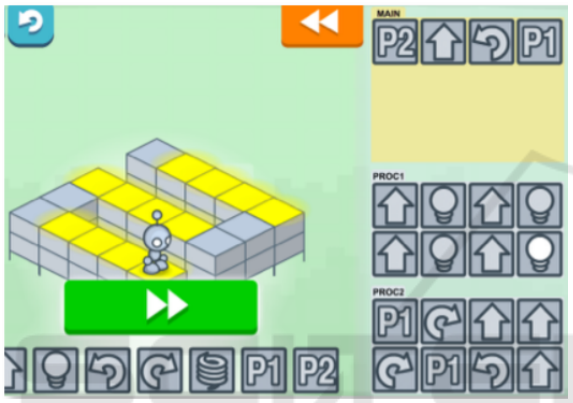

Figure 11: The complex of educational IT devices' games "Lightbot: Code Hour".

same time, the organization of practice, consolidation of knowledge sometimes loses its didactic value due to the formality of this type of work, the uniformity of educational exercises. That is why the advantage of using in educational practice such educational applications as "Lightbot: Code Hour", "Programming for children" gives students the opportunity to practice learning methods in a variety of game learning tasks; attractive, expressive form of presentation of the material; availability of various forms of encouragement and provision of timely assistance to educational institutions, which provides an activity approach of students to the acquisition and consolidation of knowledge.

Some additional principles to be taken into consideration at interactive models design are: developed e-simulators should provide support (step by step assistance) of learners' activity to achieve success and completeness at tasks performing; developed e-simulators should provide an opportunity to verify the correctness of the obtained result.

On the one hand, to succeed in learning it is important for a child to have an opportunity to achieve his intended result. Timely assistance is crucial for learners who have just started learning. Developed e-simulators contain elements that provide necessary support for a learner. Every child who works with the model can get help in time. A child can get help after his request in the form of textual commentary, additional constructions, and solution. The system of multi-level assistance in E-simulators focuses on achievement the result by each child.

On the other hand, training should be accompanied by overcoming difficulties feasible for a learner. Depriving a learner of difficulties we, however, deny him feeling joy and pleasure of success gained through his/her own efforts. Difficulties in the learning process are essential to meet learner's needs in cognitive activity. Therefore, learner's assistance at difficulties should be dosed, not excessive, but sufficient to support his efforts and aimed at making him/her overcome obstacles himself/herself. Learners in their learning activities should not act on a pattern and algorithm and retain the right to initiative, possible errors and their correction. A learner should be relaxed in his own actions. The experience in this activity is now appreciated higher than well learned rules in solving typical tasks as this experience teaches a learner how to acquire knowledge.

Taking dosage help for learners in e-simulators is a complex task and is currently being implemented fairly rarely, but this assistance will help developing initiatives to identify creative abilities, creating strong-willed child. Successful and progressing schoolchildren can employ maximum available to overcome difficulty level tasks for schoolchildren.

2.3 Interactive Tools for Construction Authors' e-Simulators by Primary Teachers-to-Be

We would like to show the basic tools for construction interactive authors' e-simulators. A teacher-to-be, creating e-simulators, independently, can use modern tool kits to create interactive exercises and didactic computer games. The interface of many tool kits, oriented to design author's didactic resources, is simplified and intuitive for an average user and it does not require additional training. In addition, as a rule, these tools include a set of templates for rapid development and offer the available examples.

To develop e-simulators a teacher-to-be can use programs that are part of an integrated Microsoft Office package, spreadsheets and applications to create presentations.

The choice of these applications is due to several reasons:

- wide spread of Microsoft Office package among different specialists;
- preparedness of teachers-to-be to use office technology in teaching;
- presence of large collections of teaching resources developed by teachers for their own educational activities. Ready didactic resources are available to teachers and can be adapted to the conditions of a particular grade and lesson;
- teachers' experience of usage software package for the preparation of teaching and learning materials, documents, etc.;
- possibilities to integrate various forms of information in e-simulators, so, slide or book may contain author's drawings prepared in appropriate graphics software, sounds, prepared in music editors, text fragments.

There are the examples of authors' e-simulators. Electronic simulators developed by our students from H. S. Skovoroda Kharkiv National Pedagogical University, teachers-to-be for young learners for primary school to teach Maths in Microsoft Excel spreadsheet are presented in the form of tests, didactic games, crossword puzzle (figures 12-14).

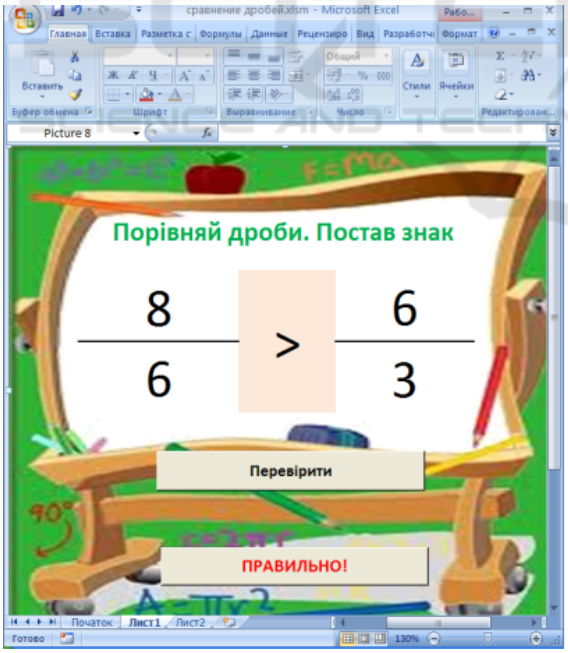

Figure 12: E-simulator for learning fractions developed in Microsoft Excel.

Basically, such capabilities provide convenience to create training systems in Microsoft Excel:

- data exchange between applications which facilitates the process of preparing the environment for

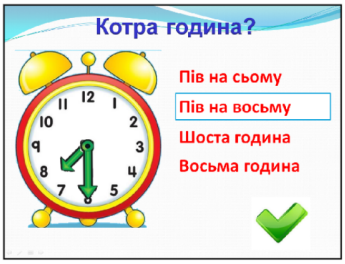

Figure 13: E-simulators for learning analog clocks.

Figure 14: E-simulators for learning multiplication tables.

e-simulators and enables to provide an attractive appearance;

- modifications and additions to the tasks when they are needed;
- programmable generation of numerical values in the text of tasks and answers. This allows preventing memorizing the answers by learners and provides variation of the tasks.
- simplification of the analysis of the assignment correctness by the relevant functions;
- presentation of the test results in the form of tables, charts, graphics, etc.;
- storage of test results and the ability to further analysis;
- availability of templates to create tests that are available to teachers-to-be at any time.

The advantage of using presentation software to develop automated tests is the possibility of their attractive design, providing a soundtrack, the ability to support each task or question with a desired scheme or pattern. In addition, the PowerPoint environment allows the construction of matching tasks, where the correspondence between the elements of two sets is defined, the tasks of ordering the sequence of actions.

Of special convenience for a teacher-to-be is the access to ready-made templates that have a pro-

Figure 15: The complex of educational games “Rebus1”.

grammed tasks check. In the environment of Microsoft PowerPoint presentation the electronic simulators developed by our students are presented (figures 14, 15). The e-simulators include controls designed for automatic creation of tasks for learners and elements that analyze user actions.

However, the development of electronic simulators in these packages requires knowledge of the programming language Visual Basic for Application and it is a painstaking task for a teacher-to-be. To create e-simulators primary school teachers-to-be can use designing environments which include a substantial set of templates and patterns associated with school material. In particular, such app designers can be useful for a teacher-to-be. They are the designers: Classtools.net, Rebus1.com, Zondle, Learningapps.org, Studystack, and others.

Within the environment “Classtools.net” (http://classtools.net/) a teacher-to-be can develop interactive posters, charts, diagrams, computer educational games to support any school subject such as Maths, Science, Reading and more. The environment is an online resource that offers a set of templates for creating teaching tools. In particular, enables to create computer games such as quizzes in the form of arcade games (search for pairs of questions and answers, hitting the target with the answer), creates tasks related to the grouping of elements, allows to create interactive posters in which an explaining text is shown when you hover your mouse on a specific part of the image. Of special convenience for teachers-to-be is that developed e-simulators can be stored on the server for the organization of joint work of learners, on the local computer for future use in the classroom, or printed out.

An interesting experience is the work of young students with puzzles. For example, the Ukrainian-language puzzle generator “Rebus1.com” (http://rebus1.com/ua/) allows the teacher to generate any puzzle on a specific request (word, phrase). Within the environment, you can create special puzzles for the first-second grade students, using fairy-tale, and cartoon characters (figure 15).

Despite the fact that puzzle tasks contain images that are easy for students to understand, their interpretation requires a number of mental actions: to determine the main / secondary information, to explain the meaning of the word (text fragment), to establish cause-and-effect relationships, to establish an algorithm, provide a description of the object, explain the purpose of the object (process), draw conclusions, etc. The advantage of using computer puzzles is that independence in such work is achieved due to the instantaneous reaction of the software to the actions of the student, because if students have some difficulties, the program provides additional guidance. The correct solution of tasks is accompanied by various forms of encouragement – appropriate musical accompaniment, approving gestures of the main characters of the program. Promptly and timely individualized assistance and various forms of encouragement stimulate to solve problems of higher complexity, cause the student a positive attitude to independent practical activities.

The didactic games designer “Zondle” (http://www.zondle.com) allows a teacher-to-be to create e-simulators for any subject. The designer offers template games to fill in with the subject content. In this case, a teacher-to-be needs only to prepare assignments and choose a template of the offered. Designer offers to use certain types of tasks, among them the tasks that include:

- select the correct answer from the offered;
- enter the correct answer from the keyboard;
- confirm the correctness of a statement;
- insert missing words into the statement and others.

The environment also provides an option to develop the game plot, choose the characters and fill in substantive tasks by oneself. Creating author’s games does not require programming and additional training. The developed educational games are stored in a network that allows to use them in extra-curricular activities for learners.

The designer of interactive exercises “LearningApps.org” (learningapps.org, 2002) (http://learningapps.org) allows you to create training exercises that require practical actions from user: to place in the correct order, to choose the correct answer, to solve a crossword puzzle, to solve a puzzles, to group etc. Many templates are offered to a teacher-to-be as well as a set of ready-made interactive exercises that can be used as templates (figure 16). They help in creation of such didactic exercises that would be appropriate in a particular

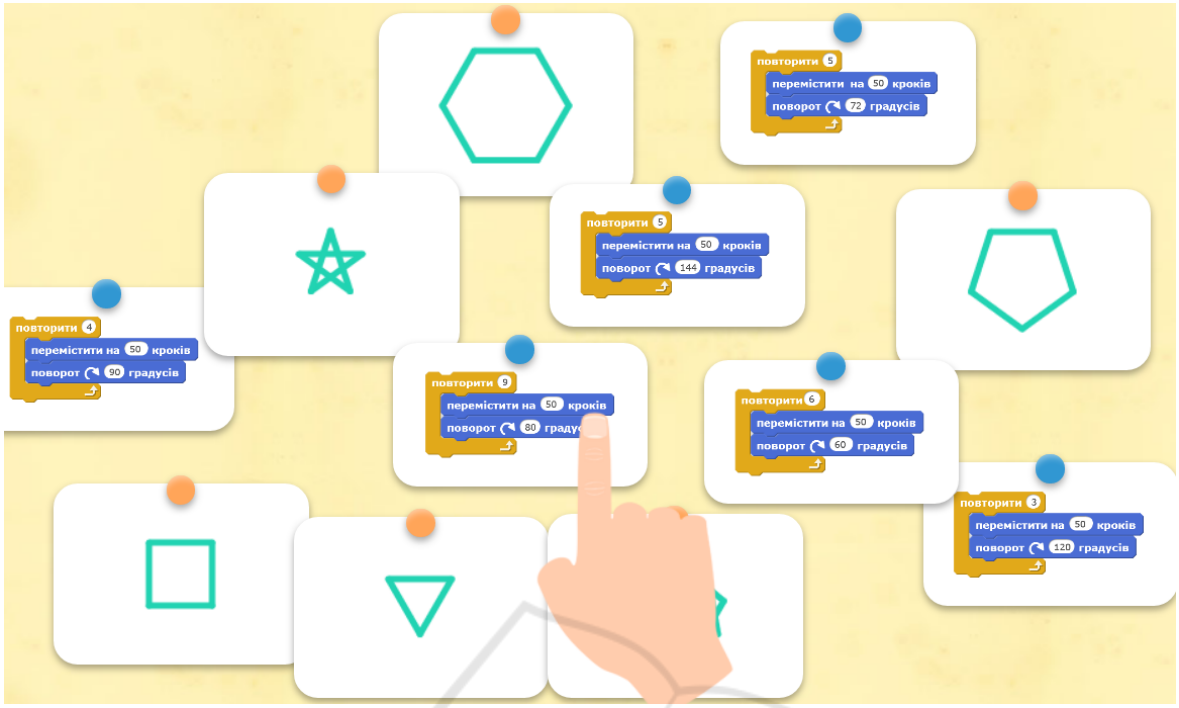

Figure 16: Examples of interactive exercises “Algorithms with cycles”.

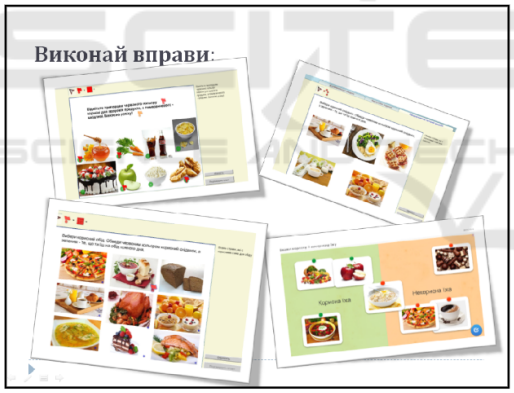

Figure 17: Examples of interactive exercises created in the LearningApps environment.

grade, in the study of a particular topic. Ready projects can be stored on a local storage or network. In figure 17 some examples of interactive exercises developed by our students are shown.

The designer of education games “Studystack” (http://www.studystack.com/) allows not only to create interactive exercises using the set of templates, but also offers practical tasks already available from a variety of subjects: Mathematics, ICT, Nature, Art, History, etc. Projects are stored on the server, which allows to use them both at the school and as home training. The designer has been working since 2001 and has accumulated a significant amount of ready interactive exercises for children from preschool to high school. The advantage of using this designer is ease of preparation of training exercises: a teacher-to-be simply enters tasks text and correct answers, on which base different versions of interactive exercises are created automatically such as quizzes, crosswords, hit on target games and hangman games, etc.

To create e-simulators a teacher-to-be can also use an environment “GeoGebra” (http://www.geogebra.org). It is very popular nowadays (Drushlyak et al., 2020; Kramarenko et al., 2020). Some examples of e-simulators developed by our students for young learners on GeoGebra are shown in figures 18, 19.

All e-simulators were developed by teachers-to-be for primary school during their studies at H. S. Skovoroda Kharkiv National Pedagogical University. E-simulators in figures are original and tested by the students during teaching practice. They are always available for primary school teachers. We think that the experience for the development of these e-simulators will be useful for teachers-to-be, and teachers in their professional activities.

3 DISCUSSION

The main results of effectiveness of e-simulators are confirmed by many scholars, namely:

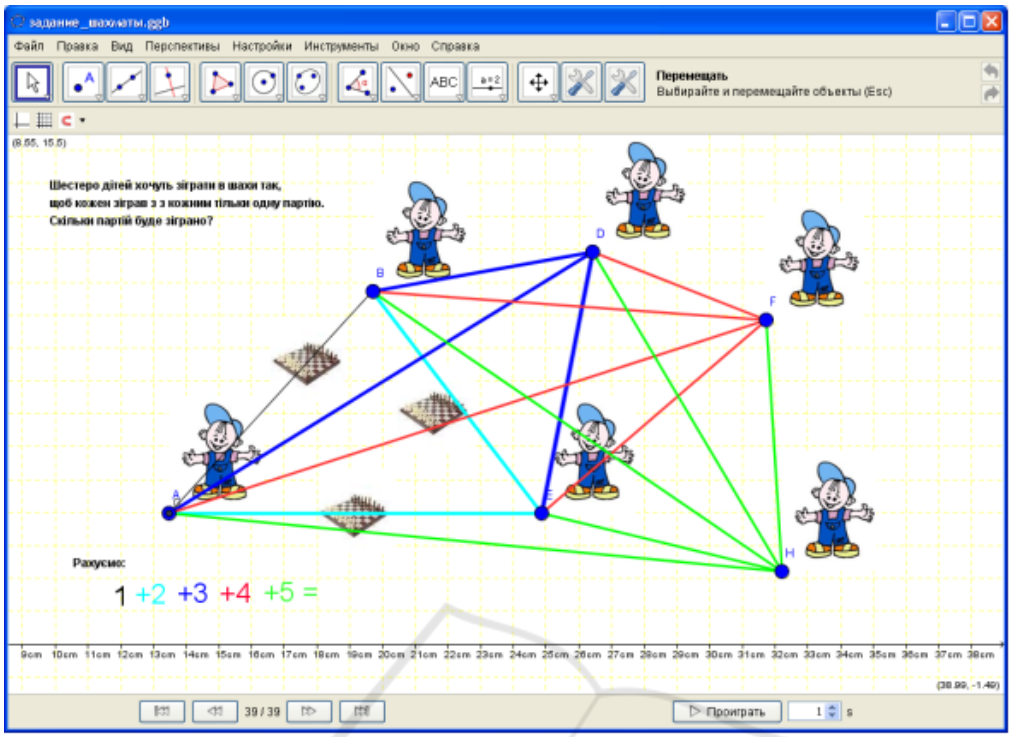

Figure 18: E-simulator for task about chess: Six children want to play chess, so that everyone plays with each player once. Find how many parties will be played?

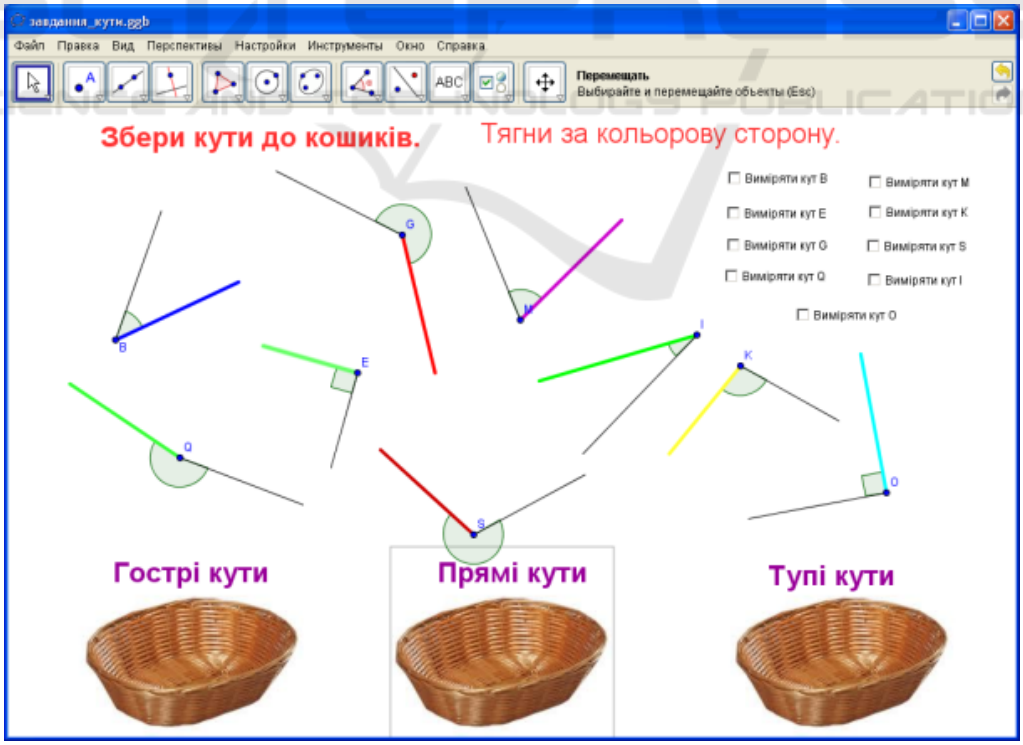

Figure 19: E-simulators for tasks about angles. Children collect right, obtuse and acute angles into baskets.

- instead of being knowledge-focused, e-simulators are built around the skills (Alayyar et al., 2012) necessary to carry out specified tasks in primary school; the focus is on what young learners can do at lessons rather than on what they know;
- young learners are expected to demonstrate practice-added skills which are assessed by looking at outcomes of e-simulators rather than process (www.curriculumonline.ie, 2001);
- young learners' performance is evaluated during the instructional process against common learning standards (Alayyar et al., 2012; www.curriculumonline.ie, 2001), and all forms of assessment are standards-based and criterion-referenced (Hughes and Daniels, 2013). After all, teachers-to-be will be able to deliberately choose the most effective direction in learning young learners with e-simulators.

4 CONCLUSIONS

Use of e-simulators is an effective way of developing successful general study skills for young learners. E-simulators feature the ability to provide real variability of tasks, uniqueness of exercises, operative assessment of correctness in each task, adjustment of task difficulty, ability to provide a shade of competitiveness and game to the exercises. E-simulators can be created by the universal software tools, such programs that are part of an integrated Microsoft Office package or special designing environments.

The capabilities of the e-simulators are covered, which ensure successful acquisition of knowledge, for developing young schoolchildren's skills. Considered tool kits enable a teacher-to-be to design independently author's e-simulators that meet the needs of a particular lesson, enable to achieve the lesson goal with the peculiarities of the educational process at primary school.

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