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CREATION OF INFORMATION TECHNOLOGIES BY THE MULTIMEDIA TRAINING COMPLEX FOR TEACHING STUDENTS OF THE 5TH GRADES OF THE BASICS OF ALGORITHMIZATION AND PROGRAMMING

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Abstract*.Technological changes taking place in modern society require students to become familiar with the basic principles of robotics. To do this, children should learn the Scratch programming language taught in computer science lessons in grades 5-6.*

Purpose of the work: description of the process of creation of multimedia training complex by means of information technologies for teaching students of the 5th grades of the basics of algorithmization and programming.

Tasks that were solved: to analyze the interpretations of the concept of "multimedia training complex"; compare the capabilities of software to create different components of a multimedia training complex; to develop and describe the stages of the process of development and creation of a multimedia educational complex; create a multimedia training complex and evaluate its quality; to develop methodological guidelines for teachers on the use of the created multimedia training complex in the educational process and a system of instructions for students to work with the offered educational product.

On the basis of the analysis of psychological and pedagogical works the definition of "multimedia training complex" is specified. As a result of comparing the capabilities of the software, a program has been selected to create a multimedia training complex. The stages of its creation are defined and described.

Emphasis is on continued work on the development and creation of a cover print in the form of a pipe to enhance the organization of work for students in the lesson.

Keywords*: multimedia training complex, Articulate 360, stages of creating a multimedia training complex.*

I. Introduction

In the conditions of the widespread introduction of high technologies in all spheres of life, the problem of an acquaintance of students with the basic provisions of robotics becomes urgent.

In accordance with the New State Standard for Secondary Education, practicing teachers (A. Vasilyuk, Y. Vinnytsky, A. Grigoriev, P. Klimenko, K. Nifantiev, and others) are developing elective courses, one of which is Robotics. In particular, Y. Vinnitsky and A. Grigoriev, considering the peculiarities of the organization of teaching students 8-9 grades of the basics of robotics, emphasize that before starting to program robotic platforms, children should master the language of Scratch programming, which is learned in computer science lessons in Grades 5-6.

The Concept of the New Ukrainian School focuses on "the cross-cutting use of ICT in the educational process, which should move from one-off projects to a systematic process that encompasses all activities" [13, p. 8]. We agree with A. Kolyada's opinion

that "multimedia complexes have the widest opportunities to realize the principle of clarity" [10, p. 121] because they combine text, graphics, video, audio, and other educational materials.

Monitoring the websites of educational fiction publishers has led to the conclusion that there are a number of multimedia training complexes created for elementary and secondary schools. In particular, the multimedia publishing house "Razumniki" specializes in the creation of unified training complexes for different subjects, which are studied in 1-5 or 10 grades, but among them, there is no computer science. The publishing house does not foresee the availability of additional printed materials, which teachers can use in parallel with the training complex. Publishing house "Morning" specializes in creating electronic interactive textbooks on the mozaWeb platform. Almost all of them are designed for primary school.

Taking into account the necessity of the creation of multimedia training complex by means of information technologies for teaching students of 5 grades of the basics of algorithmization and programming, this work is relevant.

The study examines the process of developing and creating a multimedia training complex for teaching students the 5th grade of the basics of algorithmization and programming, which will help prepare them for perception and further mastering the basics of robotics.

II. Analytical review

A characteristic feature of the modern education system is the widespread introduction of electronic didactic teaching aids in the educational process, which scholars call differently.

The analysis of psychological and pedagogical works [1- 5, 7, 10, 11, 12, 14, 16-18, etc.] has led to the conclusion that among the names found in the scientific and technical literature are the following: «electronic didactic resource» (O. Melnyk, O. Mykytyuk, N. Olefirenko, N. Yantz), «electronic educational resource» (O. Melnyk), «educational software tool» (I. Morkvyan), «computer textbook» (L. Gryzun), «multimedia electronic publication» (DSTU 7157: 2010), “Multimedia Training Complex” (I. Bondar). Common in these terms is that electronic didactic teaching tools include presentations, videos, illustrations, diagrams, word clouds; interactive exercises created in various Internet services; electronic didactic complexes which include electronic textbooks, electronic workbooks, etc., which feature is mandatory for the availability of multimedia content. Combining all this, we will look at the process of creating a multimedia training complex. Let's define the essence of the concept of «multimedia training complex». The problem of creation and introduction into the educational process of multimedia educational complexes was investigated by I. Bondar, A. Kolyada, A. Mohonko, N. Pavlenko, and others.

According to DSTU 3017: 2015, the multimedia training complex can be compared to a multimedia electronic publication, in which the text, sound, graphics, and other information is equally and interconnected using the appropriate software [8].

I. Bondar under the multimedia training complex understands the combination of educational texts with different types of content that ensure the independent acquisition of knowledge on a particular subject on the basis of the user's own learning path [3].

A. Mohonko, considering multimedia training complex as a promising way of teaching children, makes clarification. Namely: «An electronic multimedia training complex for children is a set of specific tasks on a specific topic, which includes educational and entertaining elements, is interactive and promotes the acquisition of theoretical material and practical skills» [12].

Based on the above interpretations of the term "multimedia training complex" by this term we will understand a multimedia electronic publication, which will combine educational texts, supporting notes, creative tasks and other educational or explanatory material to facilitate the learning of the theory and practice.

There are a number of software tools available to create multimedia learning complexes. They are divided into online applications and software that need to be installed on your PC.

The most popular software installed on your computer or laptop is Adobe Captivate, Articulate 360, Gitbook, AutoPlay Media Studio, mozaWeb, PubCode, and others. When comparing their capabilities to create a multimedia training complex, we identified the following: text creation and layout; embedding presentations; video recording and processing; import PDF, Word, Epub, HTML2 or PowerPoint files; availability of interactive templates; creating your own project design; availability of additional services (libraries, cloud storage, etc.); creation of animation, interactive testing, scenarios with virtual reality technology; support for program code; export of e-courses in different formats; placement in the WEB space; publication of the created application for application on different mobile devices; placement of 3D objects payment for using the program (see Table 1).

In order to compare online applications, we paid attention to their ability: to place text, audio, and video information; share textbook editing; publish to the developer platform import various PDFs, markup work in a ready-made application, create electronic tutorials in a mobile application, etc. (see Table 2).

Table 1

General features of the software to create a multimedia training complex

Criterion / Program	Creation and design of the text	Embedding presentations	Record and process video	Import files of various formats (Epub, PDF, HTML2, etc.)	Availability of interactive templates	Creating your own project design	Availability of additional services (libraries, cloud storage, etc.)	Creating animations	Creation of interactive testing	Creating with virtual reality technology	Code support	Exports of electronic course in different formats	Placement in the WEB space	Publication of the created application for use on different mobile devices	Placement of 3D objects	Payment for using the program
Adobe Captivate	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+
AutoPlay Media Studio	+	-	-	+	-	+	+	+	+	-	+	+	-	-	-	+
ISpring	+	+	+	+	+	+	+	+	+	-	+	+	+	+	-	±
Articulate Storyline 360	+	+ *(Add slides to the created presentation)*	+	+	+	+	+	+	+	+	+	+	+	+	+	±

Kotobee	+	-	+	+	+	+	+	+	-	-	+	+	+	+	+	±
PubCoder	+	-	-	-	+	+	+	-	-	-	-	+	+	+	-	+
mozaWeb	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	+

Table 2

General features of online applications to create a multimedia training complex

Criterion / Program	Placement of text, video and audio information	Granting joint access to editing	Publishing a finished tutorial on the developer site	Import PDF-files	Adding notes	Ability to create materials in the mobile app
Gitbook *(https://www.gitbook.com/)*	+	+	+	+	-	-
FlippingBook *(https://flippingbook.com/)*	-	-	+	+	+	-
Active Text Book (*https://activetextbook.com/)*	+	-	+	+	+	+
Book creator (*https://bookcreator.com/)*	+	-	+	+	-	-

A comparative analysis of the capabilities of the software has made it possible to conclude that from all the variety of software that is installed on a computer or laptop and services to create multimedia training complexes *Articulate 360*. This application allows you to work with audio and video content, 3D -objects. It also has interactive templates, the ability to add animation effects, export to different formats, adapt to the use of ready edition on different mobile devices, organizes collaboration on creating your own product.

III. Object, subject and research methods

The purpose of this work is to substantiate the process of the creation of multimedia training complexes by means of information technologies for teaching students of the 5th grade of the basics of algorithmization and programming.

The object of research is a multimedia training complex for teaching students of the 5th grade of the basics of algorithmization and programming.

The subject of the research is the development of the stages of the process of creation of multimedia training complex by means of information technologies for teaching the 5th-grade students.

According to the purpose of the study, the following tasks were set:

– to determine the essence of the concept of "multimedia training complex" on the basis of the performed analysis of scientific and pedagogical and technical literature;

– compare software capabilities to create different components of a multimedia training complex;

– to develop and describe the stages of the process of development and creation of a multimedia educational complex;

– create a multimedia training complex and define criteria for evaluating its quality;

– to develop methodological guidelines for teachers to use the created multimedia training complex in the educational process and a system of instructions for students to work with the proposed educational product.

IV. Results of work

During the creation of the multimedia training complex for teaching the students of the 5th grades of the basics of algorithmization and programming the following steps were distinguished and the following steps were performed:

1. Defining the theme and purpose of its creation.

According to the program in computer science for students of 5-9 grades of general educational institutions in studying the topic «Algorithms and programs» children should: clearly understand and explain the concepts of algorithm and program, be aware of their meaning in life; to know different algorithmic structures, to understand their essence, to be able to distinguish these structures and to apply in solving the task; give examples of the performers and the teams they perform; use the environment to describe and execute algorithms and more.

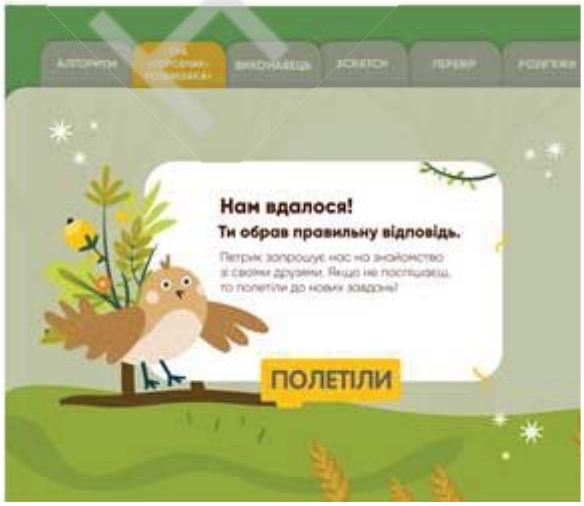
Feature of this multimedia training complex is:

− organizing trips to countries of the world (Ukraine, Israel, Switzerland, Germany, Finland, South Korea), during which students should familiarize themselves with theoretical material, complete logical or practical tasks, take tests and if desired, perform creative tasks;

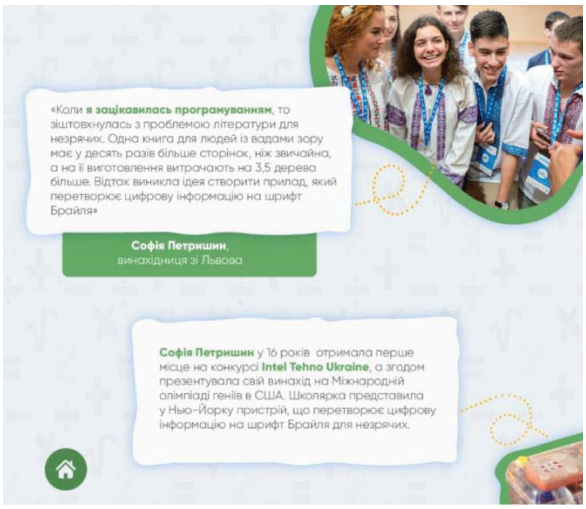
− the introduction of assisting heroes who present tasks for execution, provide clues or outline the theory of the game. For example, "Panda Superhero" – learns with programming students. Animals or birds are symbols of the countries where the study tour is conducted). "Beaver" – a symbol of the international competition in computer science (it means the presence of a creative task);

− the presence of pages with motivational text (Pic. 1) or interesting facts about the development of the IT industry in the country where the lesson was stopped (Pic. 2). Preferably, each supplemented motivational insert animation gif;

− creating animated tips; explanatory text that pops up when you hover your mouse cursor.



Pic. 1. Design of motivational insertion



Pic. 2. Window with interesting facts

2. Define the target audience.

The target audience is 5th-grade students (9-12 years old), who study in various secondary education institutions, either in distance education or in external studies.

3. Determination of the functions that multimedia training complex should perform.

Among the features that should be implemented with the help of this multimedia training complex were the following:

− motivational (facilitating the emergence of students' interest in mastering the basics of algorithmization and programming for further use in the study of other elective courses, in particular, in robotics);

− informative (knowledge formation on the topic "Fundamentals of algorithmization and programming"; ability to apply basic structures of the algorithm in solving practical tasks; developing skills for their use in creating code in Scratch programming environment, etc.);

− supervising (diagnosing students' level of learning with the help of different types of controls (tests, interactive exercises, tasks for practical implementation in the Scratch programming environment);

− reflexive (enabling students to control their knowledge and skills independently).

4. Definition of technical requirements.

The multimedia training complex that is being created should be properly opened, either on a desktop computer or laptop or a smartphone or tablet; no additional installation on the device and no additional applications.

Given these requirements and the results of the analysis of the capabilities of the software for creating multimedia training complexes, we have chosen the program Articulate 360.

5. Identification of topics, selection, elaboration, and development of material required.

Following with the stated purpose of creating a multimedia training course, material from the basics of algorithmization and programming was elaborated, given in textbooks and workbooks for the 5th grade and the necessary educational or explanatory texts were determined. On their basis it was:

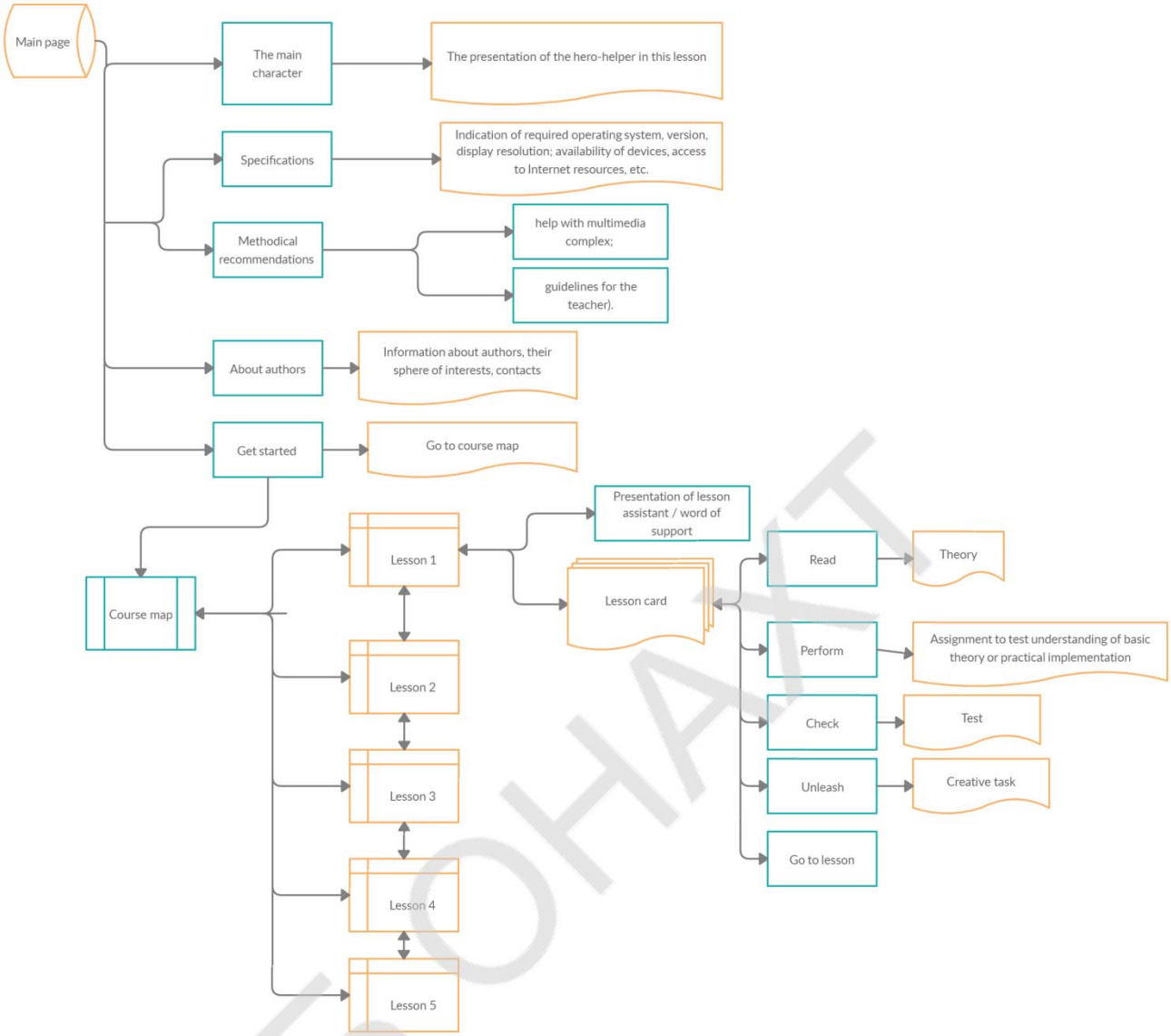
− synopsis lessons have been developed to which reference notes have been created, presented in the form of diagrams, tables, interactive posters, etc;

− formulated creative tasks and tasks for independent practice or performance;

− developed guidelines, tips for implementation and so on.

6. Development of structural scheme of multimedia training complex, determination of its main elements and ways of their presentation.

Following with the defined purpose, objectives and lessons learned, the following structure of the multimedia training complex was developed (see Pic. 3).

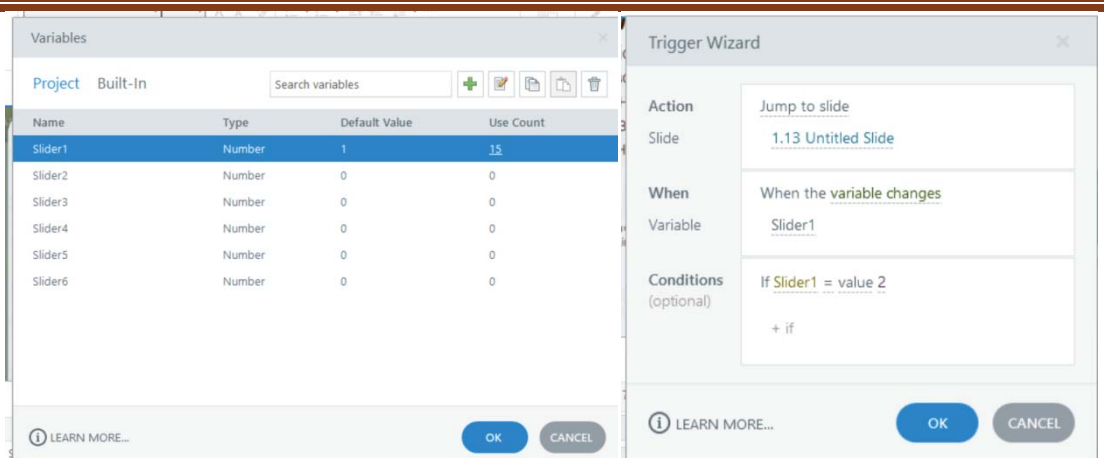


Pic. 3. Structure of the multimedia training complex

7. Develop a system of guidance for students on how to work with a multimedia training complex with the use of multimedia and interactive elements.

The electronic edition provides various multimedia and interactive elements. The buttons were created using the «Insert Picture» – «Trigger Wizard» feature. In the window «Trigger Wizard» we provide the button of functionality. Usually, these were «Jump to slide», «Show layer», «Change the state of» (Select (for button illumination), Hover (for a button with popup tips)). The Hover function is specified in the Timeline - State field.

In addition to the usual buttons, the edition contained a slider that was designed using the Slider function. However, for it to work correctly, two ways were tested: inserting a slider into layers (hidden pages in a slide) and inserting a slider into slides (pages) of a project. Unfortunately, the first variant did not work correctly, so the author developed his method of using the "Variables" function. The author manually set the values of the variables that the slider should perform (Pic. 4).

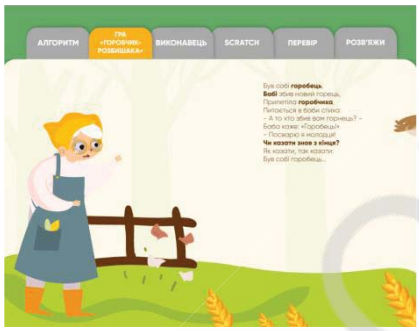


Pic. 4. Application of variables

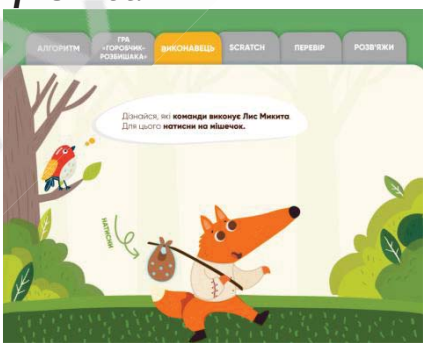
8. Developing and designing the necessary content (creating animated stories or hints, videos and audio tracks).

The animation was created for the dynamic presentation of educational material using programs such as Adobe Photoshop, Articulate 360 (Pic. 5 and 6).

Animation created in Adobe Photoshop is saved in ***.gif*** format.



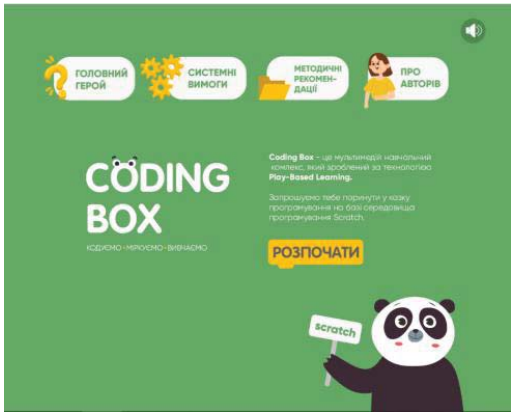
Pic 5. An on-screen copy of a snippet of the animated story



Pic. 6. An example of an animated tooltip *(Click arrows)*

The multimedia educational complex contains audio and video materials.

The audio tracks can be edited or recorded in the Articulate Storilane program itself. It is worth noting that the publication contains not only music (recorded by the author of the edition), but also audio explanations of individual tasks. Added audio tracks were saved in ***.mp3*** format (Pic. 7).

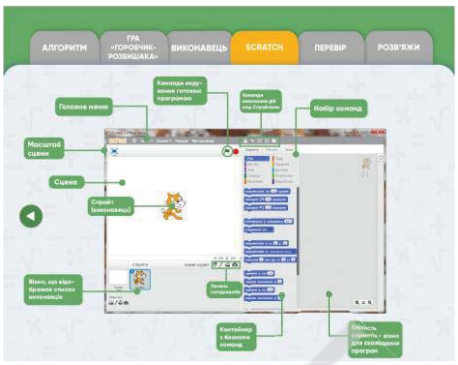


Pic. 7. Placing the audio track on the main page of the project

9. Creating and processing graphic images (interface elements, circuits, actors, etc.).

The multimedia interface has been created in Adobe Illustrator. An example of one of the created windows is shown in pic. 8 and 9.

Pic 8. Example page



Pic. 9. Scratch programming environment diagram

10. Defining the type of tasks for knowledge assessment.

Two types of testing were chosen during the development process. Test tasks were performed using Articulate 360.

Multiple responses. The correct answer consists of more than one option (see Pic. 10).

Matching. This type of interaction represents two types of elements. The student must connect each element of the first row to the element of the second (see Pic. 11).

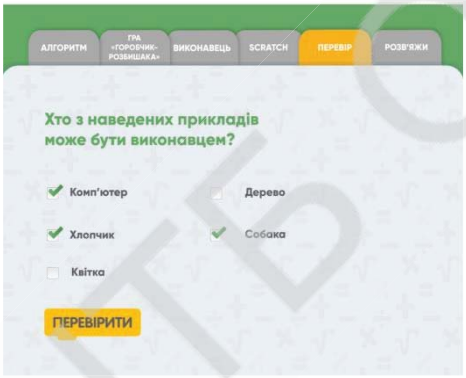


Рис. 10. Multiple responses

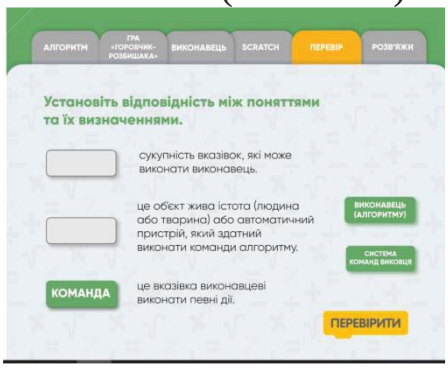
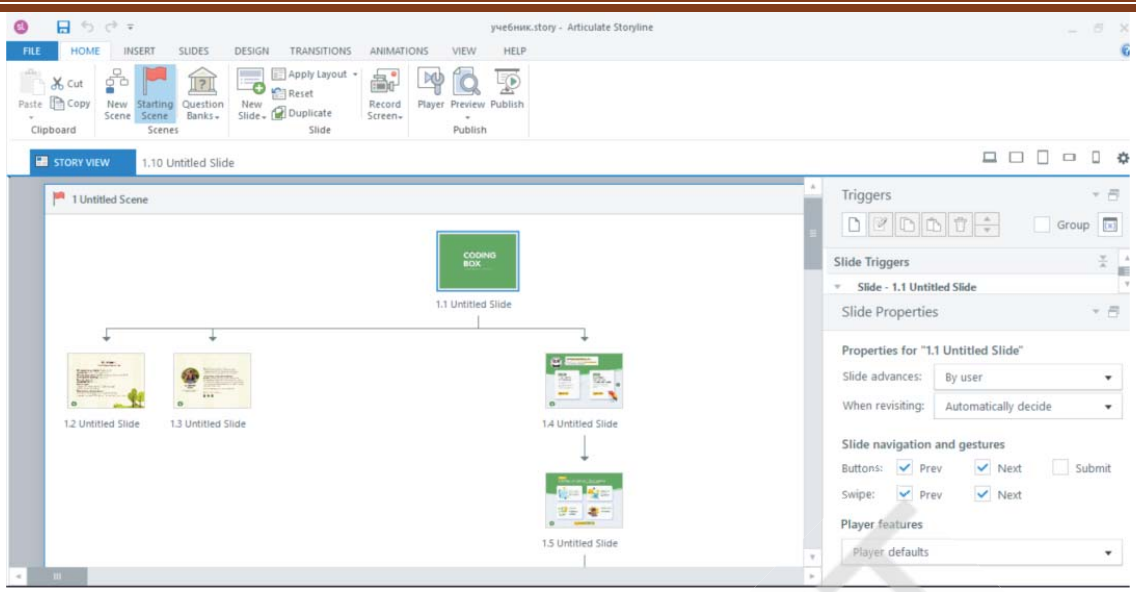


Рис. 11. Matching

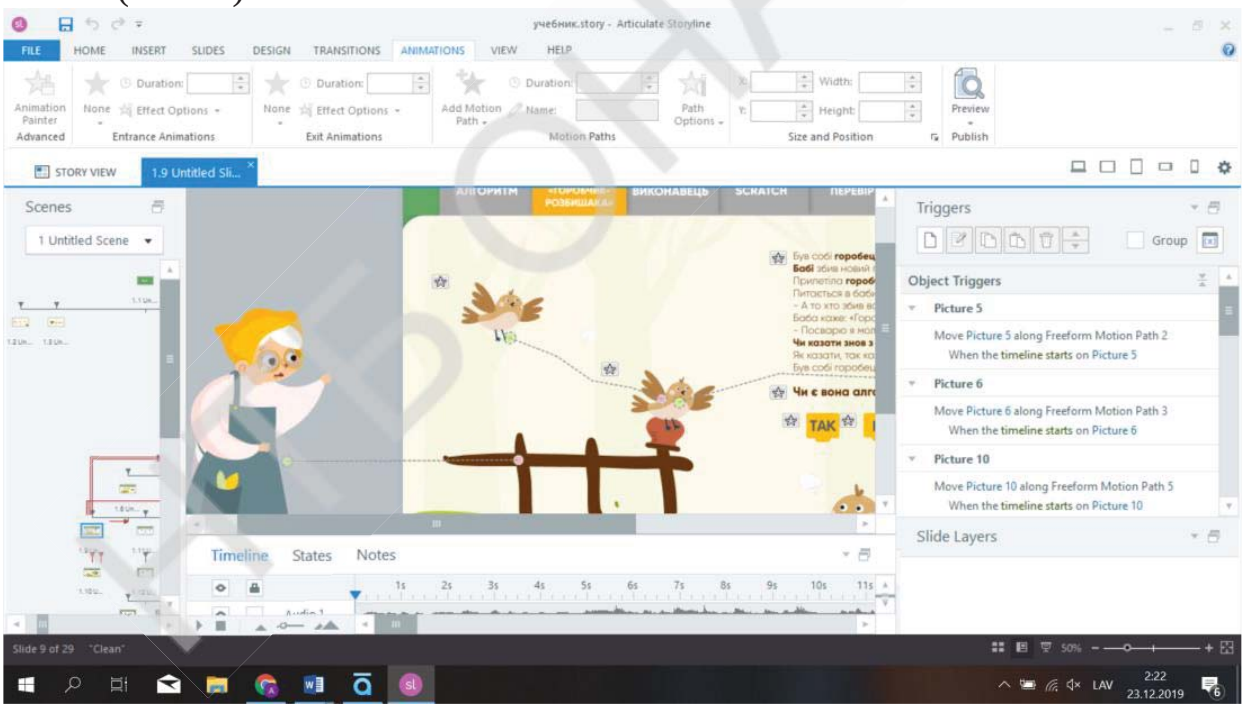
11. Composition of all created elements of the multimedia training complex.

The peculiarity of the layout of all the created elements of the multimedia training complex in the Articulate 360 program is that it has a structural diagram of the project itself, with which you can view the connections between the slides (Pic. 12) and automate the work of the embedded elements.



Pic. 12. Structural diagram of the project in the Articulate 360 program

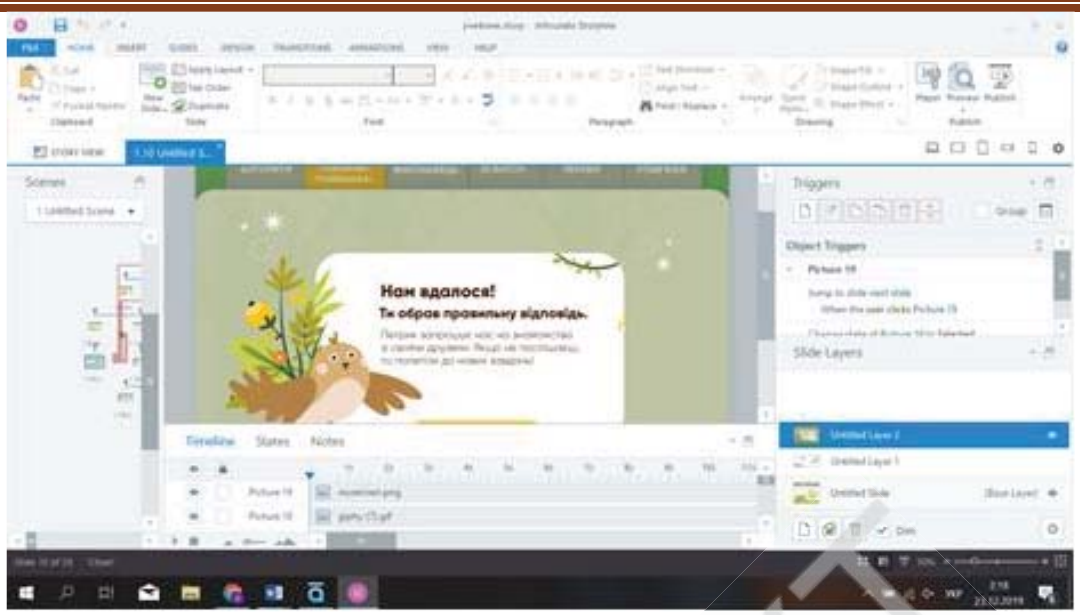
When creating page-to-page transitions as well as animation elements in the middle of the pages, the manual method - Animation - "Add Motion Path" - "Freedom" was used. Each animation must specify the time of appearance and the time of disappearance on the Timeline scale (Pic. 13).



Pic. 13. An example of adding animation to a project slide

Hidden layers on the slide were used to optimize the project. They are usually added to slides where there is a task and it is necessary to show motivational speech bauble when the right answer or the wrong one was chosen.

The layers are set using the New layer function in the slide and layer editing panel (Pic. 14).



Pic. 14. Example of using layers on a slide

12. Testing the correctness of the work of all elements of the complex, if necessary - it's debugging (error correction).

There are three types of testing: α-testing, β-testing, and testing on a computer user's.

Alpha testing (α) involves bug detection by the software developer. It encountered the following errors as a failure to configure buttons that would allow the user to move from one page of the lesson menu to another.

Beta testing (β) is conducted with the participation of invited users. This type of testing was done using the service https://360.articulate.com/. The saved project was able to be protested by five people who did not find any errors in the technical part but provided recommendations regarding the ergonomics of the interface.

After debugging, the final version of the project was saved in different formats.

The testing of the project was carried out on the operating system Windows 10. During testing, the program worked without interruption.

After testing, the finished product was recorded on a disk for which a special cover design with the original data was created (Pic. 15).

Pic. 15. An example of the created back of the cover disc boxes

13. Development of methodological guidelines for teachers to use the created multimedia educational complex in the educational process.

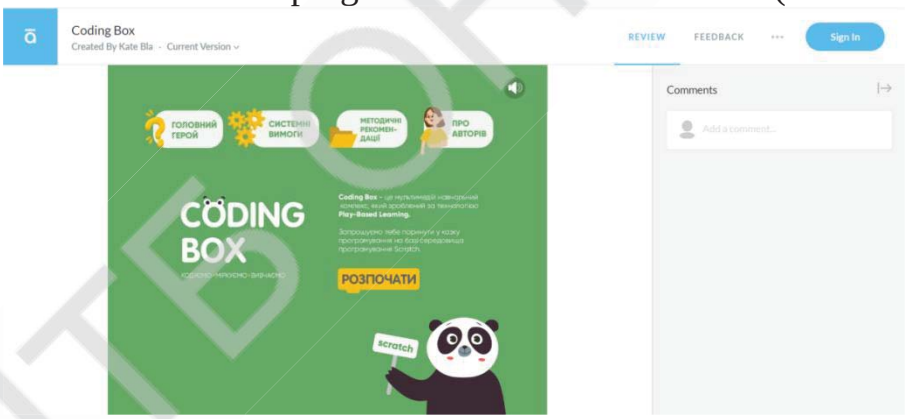
The multimedia suite includes a tutorial that was developed in Adobe InDesign and published as an interactive pdf (Pic. 16).

The edition also includes hyperlinks that are embedded in the middle of the images.

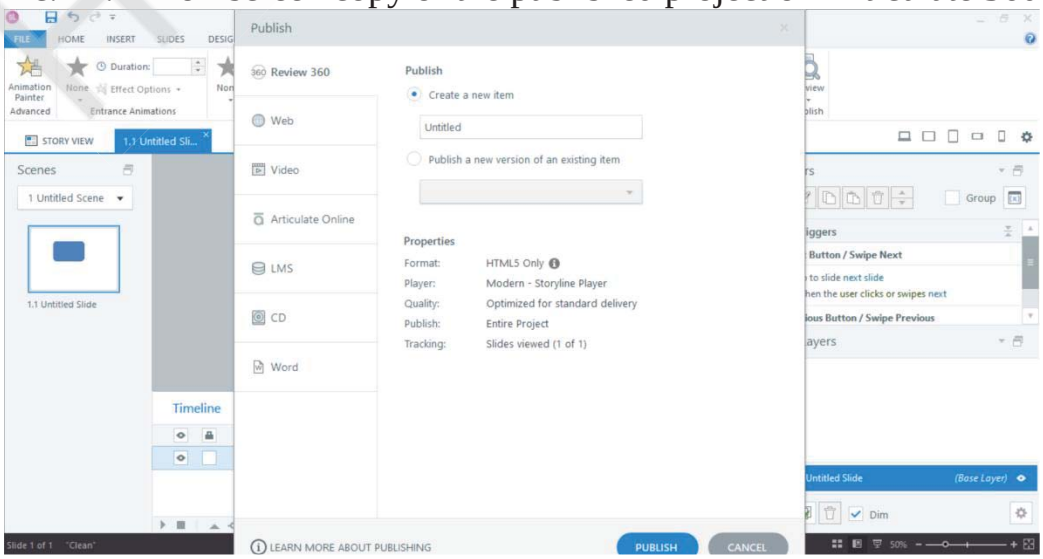
Pic. 16. Help with multimedia complex

14. Saving the created complex on the storage medium.

One of the benefits of using Articulate is storing a finished project in several formats. Namely, as an application that is installed on your computer and a web page that can be accessed on the website of the program itself or in the browser (Pic. 17 and 18).



Pic. 17. An on-screen copy of the published project on Articulate 360



Pic. 18. Save the project in different formats

15. Evaluation of the quality of the created product.

The multimedia training complex was provided for peer review by teachers of computer science and teachers who teach information technology in pedagogical institutions of higher education. As a result, some errors were identified in the formulations and tasks provided, which were revised and corrected and guidelines developed for teachers regarding the use of the created multimedia educational complex in the educational process, and a system of guidance for students to work with the offered educational product was created.

The beta version of the complex was used by the authors during the lessons of computer science in the 5th grade during the pedagogical practice, which allowed us to identify and take into account certain shortcomings in the structure of the complex.

V. Conclusions

Created by the described stages multimedia training complex for teaching students 5 grades of the basics of algorithmization and programming aimed at improving their understanding of the terms "algorithm", "executor", "guidance system performer"; knowledge of types of representation of algorithms; the ability to transform algorithms from verbal to graphic or vice versa, to apply different algorithmic structures when performing practical tasks.

Our study does not exhaust all aspects of the problem raised. In the future, it is planned to develop printed editions in the form of notebooks, which will increase the possibilities of organizing the work of students while learning new complex material.

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