O. S. Martyniuk

Lesia Ukrainka Eastern European National University

THREE-DIMENSIONAL PROTOTYPING AS A COMPONENT OF STEM- TECHNOLOGIES IN STRUCTURAL AND TECHNICAL AND RESEARCH WORK OF STUDENTS AND PUPILS

The article presents a designed and developed printer for three-dimensional prototyping. The necessity of introduction of STEM-technologies for updating of educational-methodical and technological base for realization of innovative approaches is substantiated. The results of researches of domestic and foreign scientists are analyzed, as well as the legal framework in the field of use and implementation of the means of additive technologies in the educational and scientific fields. According to the results of the analysis, it was concluded that the main problem in the active implementation and use of additive technologies is the low level of material support, the lack of appropriate equipment or the inability to work with such equipment. Described and designed by students and students 3D-printer, which has been successfully tested in practice. The steps involved in setting up the printer, the software used, a generic sequence of setting up the printer, and some problems you may encounter while printing. Analyzing the state of logistical support, we can conclude on the necessity and expediency of using additive technologies in the design, manufacture and modernization of training equipment. The use of 3D-prototyping reduces the cost of manufacturing non-serial items or accessories. Working on the design and production of physics training equipment offers great opportunities for enhancing the cognitive activity of students and students.

Key words: STEM-technologies, educational robotics, three-dimensional prototyping, 3D-printer.

Отримано: 17.03.2019

УДК 371.315.7

DOI: 10.326626/2307-4507.2019-25.64-67

T. Pylypiuk

Kamianets-Podilskyi National Ivan Ohiienko University

e-mail: t-myh@i.ua

NEW LESSON DESIGN APPROACHES

The article is devoted to modern technologies of creation of pedagogical software tools of educational purpose. Tools for creating educational materials for teachers who know computer technologies are presented in the article. Among the technologies for creating educational software for educational purposes, the authors identify the program for the formation of lessons Easy School Book and the program MasterTool for the creation of interactive educational materials.

Key words: pedagogical software tools, creation tools, educational process, lesson designer, interactive learning materials.

Pedagogical software tools (PST) are software packages, which are designed to solve different training tasks and a program documentation that determines the order of application of software. Different types of PST can be used in the learning process.

They differ in program realization, goals and methods of application in the educational process.

The modern PST is an electronic multimedia tutorial that contains audiovisual materials and auxiliary texts with a set of different learning tools (visibility, model of mechanisms, instructional and technological material, control and self-control cards of knowledge, skills and abilities, etc.).

The purpose of the use of PST is:

– figurative and dynamic presentation of educational information, its systematization, constant and prompt recovery;
– development and consolidation of different skills and abilities;
– control over the acquisition of knowledge [1; 3].

The use of a computer as a means of training puts forward the task of developing a scientifically sound typology of programs both at the level of didactics and at the level of private methods, taking into account the specifics of each subject.

There are many different approaches to the classification of PST, but there is no single opinion about general classification, as noted by most authors [2; 5].

There is interesting classification, which is based on differences in approaches to drawing up programs. According to this classification there are linear, branched, generative programs, modelling and simulation programs, games, problem solving programs, free-choice programs, and dialog systems [5].

Linear programs can be used at the initial stage of training. They are based on the idea of linear programming by American psychologist B. Skinner. Their main advantages are step-by-step delivery of material, operational support (the issuance of answers at each stage), individualization of study (each student can perform tasks at a rate that corresponds to his individual peculiarities and capabilities).

In the history of programmed learning, the creation of branched programs (the idea of American psychologist N. Crowder) has been a step forward compared with linear, although the student does not construct an answer in them, but make a choice from the set of proposed ones. The main differences between this program and the linear one are: the author of the program does not proceed from the fact that the student's answer must necessarily be correct; the student receives a comment on his answer and either adjusts his work or moves further in a certain sequence [6; 7].

The programs of the mathematical model of learning, simulation programs, computer games and dialogue systems are most popular among teachers and students.

Program of free choice are popular among students because students have the opportunity to choose programs from the central computer's bank, to make requests for information of interest to them. Communication with the central data bank is carried out within the local network or using the Internet [7].

The use in the educational process of PST improves its efficiency significantly affect the content, forms, methods and means of training.

Pedagogical software envisages various forms of organization of work: collective, group, individual, which allows teachers to plan classes with maximum consideration of individual characteristics of students.

PST may be as for teachers also for students.

A significant number of PST has already been developed today. Their use allows to solve with a computer a wide range of tasks of different levels of complexity from all disciplines [3; 4].

Some of the simple and popular software tools such as MS PowerPoint, MS Publisher, SMART Notebook software, Easy School Book as lesson's designer, MasterTool software

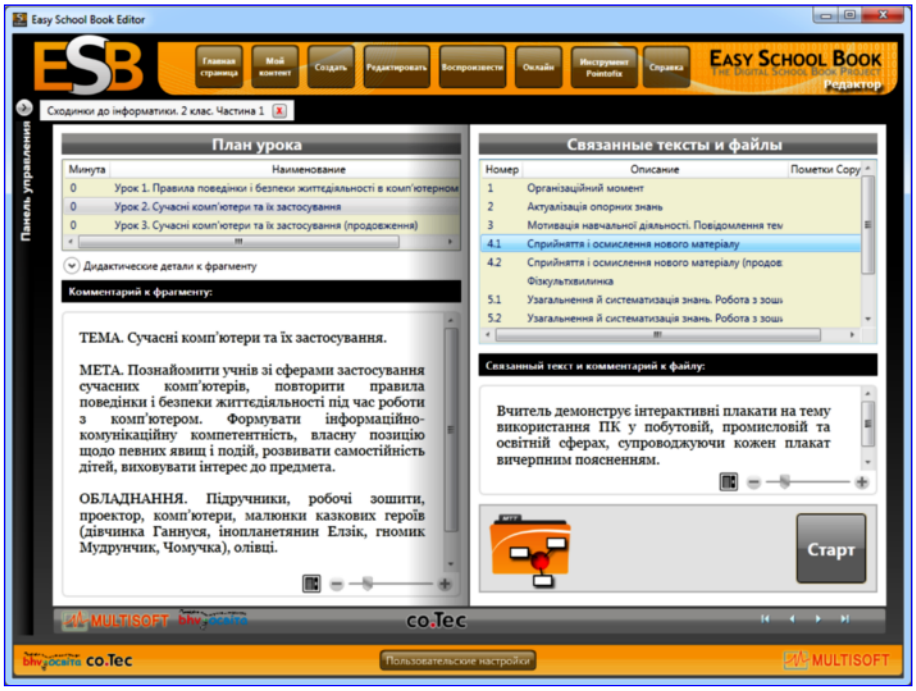

***Image № 1**. Easy School Book: a convenient lesson's designer*

for creating interactive learning materials are among the technologies for creating PST.

Such programmes as Easy School Book as a handy lesson designer and MasterTool to create interactive learning materials are new modern approaches to lesson design.

If all of the lesson materials are stored as separate documents (a text document with a lesson's plan and synopsis, a presentation, a tutorial, pdf-files, graphics), it is very inconvenient for work. Therefore, it is convenient to use another approach in which all of this objects are contained in one **Easy School Book** e-file and always are with the teacher at hand.

The structure of a book created in Easy School Book is differ from the structure of the print book and it's specially adapted to organize the objects of the lesson and conveniently manage it.

Easy School Book is a very easy to use for lesson's creation as e-book. A e-book can contain both one lesson and several, for example, all lessons on the same topic.

The book can include text, images, videos, audio, presentations and interactive exercises and tests.

Thus, Easy School Book is a specially program which is designed for teachers and allows them to store together (in one file) all the objects of the lesson (*image № 1*): **synopsis, plan, guidelines, didactic interactive materials, exercises, tests, audio, video** ets.

To work with the lesson on a local computer, there must be such programs as the Easy School Book player and programs that reproduce the objects of the lesson (for example media player, Adobe Reader, MasterTool player, Word, PowerPoint, Excel, etc.).

The lesson materials are provided as an ESB e-book with a very simple interface. The book has front pages with general information, a page with a lesson plan and a page which opens a training object that is associated with the relevant plan item.

There are two versions of Easy School Book: the player and the editor. The first allows only to use ready-made books, and the second – to develop their own and edit ready-made software and methodological kits.

The use of Easy School Book in the learning process:

1. **Organize materials that have been collected over the years of work.** With the help of the Easy School Book Editor, the teacher can create e-books with lessons containing presentations, PDF files, text documents, links to online resources, and multimedia files. Everything from the methodical piggy bank for years of work will now be streamlined and available for use.

2. **All lesson materials are always at hand.** Teacher's materials (plan, synopsis, etc.) are displayed on teacher's computer and do not distract student's attention and materials for teaching, testing, and consolidating student's knowledge are on the interactive whiteboard, projector, monitor/TV.

3. **Managing the lesson.** Teacher can quickly move from one lesson object to another, see an interactive whiteboard image on the teacher's computer, and control the time with a timer. And all this in the Easy School Book window.

4. **One lesson book – several options for teaching.** One book can accommodate material for multiple teaching trajectories, such as parallel classes, as well as additional material.

5. **Easy School Book for students.** The teacher can make books based on his book for students to work independently. It can also create books for students with different tasks.

6. **Exchange of educational materials, quick access to them.** Books can be placed centrally at a school, such as in a resource library on a server, on a teacher's computer, in cloud storage.

7. **All lesson objects in one file.** It is especially convenient that teacher can now place all of the lesson material in one book file and move it from one place to another without worrying that any object will be lost.

8. **A large number of ready-made software and methodological kits.** To help the teacher, there are various sets of lesson notes with interactive exercises and tests, which can be displayed on the interactive whiteboard of any model, projector or TV.

The Easy School Book is available, for example, at the site:

http://bhv-osvita.com/index/elektronni_zasobi_dlja_navchannja_ta_vikladannja/0-22

You can also on the site:

- download Easy School Book User's Guide. Quick start (pdf);
- download the trial version of the player;
- download a 30-days trial version of the editor;
- download ESB-book with examples and instructions «Working with interactive posters and exercises MasterTool» and three lessons from the course «Steps to computer science. Grade 2»;
- download installation instruction.

Thus, teacher can choose different uses of Easy School Book, depending on the scale of the work – individual or teacher at the classroom or the whole school level.

Lets consider using the program MasterTool.

Today, the teacher can use several programs – PowerPoint for presentations, a specialized test creation program, a word processor, a graphics editor, ets. for creating

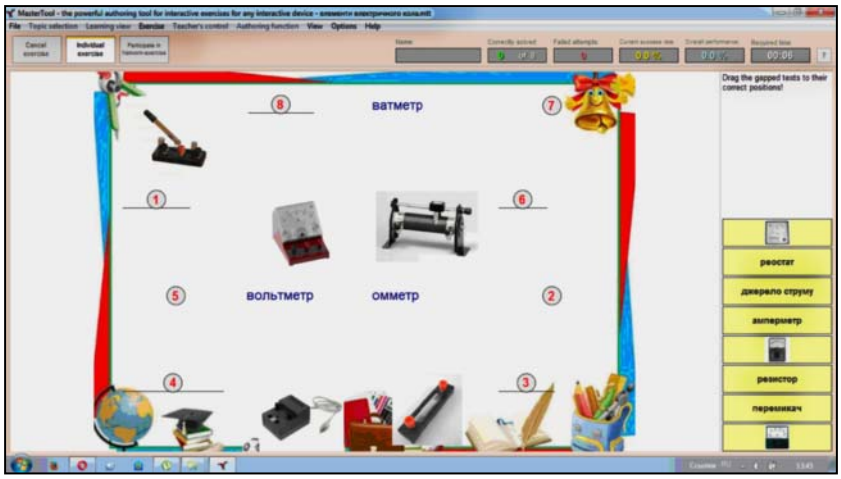

Image № 2. *MasterTool – a software tool for development and use interactive training materials*

the didactic materials of the lesson. It may also acquire the program Smart Notebook for presentation materials by the interactive whiteboard.

Instead of all these programs, teacher can use one universal program – MasterTool (*image № 2*), with which teacher can quickly develop interactive training materials of almost all existing types: interactive demonstration posters, tests of all kinds, tasks for matching, grouping, exercises in the form of text with hidden parts. All these materials can be demonstrated in the MasterTool program on the interactive whiteboard of any model, projector, TV, student's computers. To help teachers quickly develop lessons and implement a variety of teaching practices, including the use of an interactive whiteboard, MasterTool has created many pre-made software and teaching kits containing lesson notes, interactive exercises, tests and demonstrations.

MasterTool is a system for teachers that allows to create different interactive learning materials and use them on any interactive whiteboard, on a teacher's computer with a projector attached, and on student computers.

MasterTool has:

– training materials intended for teaching, training, consolidation and knowledge testing;
– the ability to showcase materials on an interactive whiteboard, projector, LCD TV, multi-touch panel and personal computer.

The use of MasterTool in the learning process:

1. **Explanation of educational material.** The use of ready-made and self-created interactive materials which contains text, pictures and videos. It is possible to control the playback of training components.

2. **Blackboard mode.** Creating in MasterTool the image of blackboard any kind (rulers, cells, sheet music) and using them to write text and create graphics.

3. **Interactive interaction between teachers and students during the explanation of the study material and the survey.** Explanatory material can be converted to an exercise or test automatically and discussion of material and student surveys can be organize.

4. **Different types of tests and exercises.** MasterTool allows create tasks and tests of various types quickly:

– text labels with pictures,
– text with spaces,
– one-answer and multiple-answer tests,
– tasks for matching,
– tasks of grouping objects into categories,
– spreadsheets with text and pictures.

The system offers several answer modes (drag and drop response cards, direct text entry, etc.), including sorting of answers and questions.

5. **Conducting network exercises.** With a school license, MasterTool is very easy to deploy in a computer classroom, and the teacher can initiate students' assignments from his computer, monitor their results in real time, and save the progress data for future use.

6. **Independently students' work at home.** If you place training materials and exercises on the Internet, students will be able to work with them at any time, including at home, using the basic version of MasterTool.

7. **Creation of printed materials.** Using the print job team, you can quickly create and print forms with tasks and tests.

8. **Independent development of educational materials.** If you purchase an authoring system, you can edit existing and create new MasterTool documents.

Two MasterTool systems are available – a **paid authoring** tool that allows you to create, store, and use study materials individually, on the school network and online, and a free **basic system** that can only be used to open and use study materials.

MasterTool Basic System is software that allows you to open and use MasterTool documents (.mtt): show interactive tutorials, run and perform tests, exercises and other tasks, save test results, print tutorials, etc. Also, this system provides all the tools for using the interactive whiteboard (drawing tools, image management, the ability to call external programs and the on-screen keyboard, create pictures of painted boards).

The **MasterTool authoring system** is software for teachers that enables them to create e-learning materials for teaching, as well as to consolidate and validate students' knowledge. Demonstration of these materials may be on an interactive whiteboard or other similar means. Exercises and tests can be done on an interactive whiteboard or on a computer. The authoring system provides all the tools for using the interactive whiteboard (drawing tools, image management functions, calling external programs and on-screen keyboards, functions for creating pictures of painted boards, etc.).

With the MasterTool authoring system teacher can create the following educational and didactic materials:

– text and graphics training materials for explanation. They may contain text and graphics that can be controlled, links to audio files, videos, other documents, pop-ups with explanatory text blocks;
– tests and exercises to consolidate skills and test knowledge. These materials can be quickly created both on the basis of a document explaining the material and can be developed separately. Specifically, you can design open-ended and closed-form test tasks, skip text (for example, for language exercises), mapping tasks, and grouping objects. They can not only be performed on a computer, but also printed and tested by students in the absence of a computer class.

The MasterTool is available, for example, at the site:

http://bhv-osvita.com/index/elektronni_zasobi_dlja_navchannja_ta_vikladannja/0-22

There are also on the site:

- Free basic system for individual use of educational materials.
- Online version of the MasterTool base system and own teacher's space for teaching online.
- Ready-made software and methodological sets of educational materials.

You can also on the site:

- download sample training materials (you must download and install the MasterTool basic system to work with the examples);
- download MasterTool instructions for quick launch (ukr. version);
- to work with MasterTool (instruction and lessons);
- download a trial version of the MasterTool authoring system;
- download a collection of MasterTool background images;
- download a collection of MasterTool background images (junior school);
- download installation instructions.

There are different options for using MasterTool depending on the scale we want to work with – as an individual teacher, at the classroom level or at the whole school level.

Teachers who are licensed under the MasterTool authoring system can use the additional MasterTool Online cloud service that provides the following features:

- online environment for placing and organizing lesson objects;
- ability to save documents (lesson objects) on-line (free of charge up to 250 MB) and use objects located locally;
- convenient interface for placing lesson objects in the desired sequence, previewing lesson objects;
- teacher can associate four board images with each lesson object and display them both together with this object and in sequence to provide an explanation for that lesson object.

Therefore, with the editors of Easy School Book and MasterTool, the teacher can modify the program kits according to their needs and create new teaching materials.

References:

1. Atamanchuk P. Fundamentals of Introduction of Innovative Techniques in Physics Education: a Manual / P. Atamanchuk, N. Sosnytska. – Kamianets-Podilskyi: Abetka-Nova, 2007. – 200 p.
2. Volynskyi V. Classification of educational software / V. Volynskyi // Computer at school and family, 2005. – № 1. – P. 19-20.
3. Konet I. Pedagogical Software for Physics: classification, analysis, creation tools / I. Konet, T. Pylypiuk // Collection of scientific works of Kamianets-Podilskyi National Ivan Ohiienko University. The pedagogical series. – Kamianets-Podilskyi: Kamianets-Podilskyi National Ivan Ohiienko University. – № 24 (2018). – P. 63-66.
4. Nakonechna L. Classification of software and pedagogical tools of study in physics / L. Nakonechna // Collection of scientific works of Kamianets-Podilskyi National Ivan Ohiienko University. The pedagogical series. – Kamianets-Podilskyi: Kamianets-Podilskyi National Ivan Ohiienko University. – № 15 (2009). – P. 300-303.
5. Pylypiuk T. The pedagogical software tools of training, their classification / T. Pylypiuk // Scientific works of Kamianets-Podilskyi National Ivan Ohiienko University: a collection by results of the scientific conference of teachers, doctoral students and post-graduate students. In 3 vol. – Kamianets-Podilskyi: Kamianets-Podilskyi National Ivan Ohiienko University, 2017. – Ed. 16. – Vol. 2. – P. 61-62.
6. Pylypiuk T. The pedagogical software tools of training for primary school: a Manual / T. Pylypiuk. – Kamianets-Podilskyi: Abetka-Svit, 2018. – 186 p.
7. Pylypiuk T. The use of pedagogical software tools in education / T. Pylypiuk // Proceedings of the XXIV International Scientific and Methodological Conference «Management of Quality of Specialists Training», April 18-19, 2019, Odessa. – Odessa: Odessa State Academy of Civil Engineering and Architecture, 2019. – Part 1. – P. 193-195.

Т. М. Пилипюк

Кам'янець-Подільський національний університет імені Івана Огієнка

НОВІ ПІДХОДИ ДО РОЗРОБКИ УРОКІВ

Стаття присвячена сучасним технологіям створення педагогічних програмних засобів навчального призначення.

У статті представлені інструменти для створення навчальних матеріалів для вчителів, які володіють комп'ютерними технологіями.

Серед технологій створення навчального програмного забезпечення для освітніх цілей виділено програми формування уроків Easy School Book та програму MasterTool для створення інтерактивних навчальних матеріалів.

Ключові слова: педагогічні програмні засоби, засоби створення, навчальний процес, конструктор уроків, інтерактивні навчальні матеріали.

Т. М. Пилипюк

Каменец-Подольский национальный университет имени Ивана Огиенко

НОВЫЕ ПОДХОДЫ К РАЗРАБОТКЕ УРОКОВ

Статья посвящена современным технологиям создания педагогических программных средств учебного назначения.

В статье представлены инструменты для создания учебных материалов для учителей, которые владеют компьютерными технологиями.

Среди технологий создания учебного программного обеспечения для образовательных целей выделено программы формирования уроков Easy School Book и программу MasterTool для создания интерактивных учебных материалов.

Ключевые слова: педагогические программные средства, средства создания, учебный процесс, конструктор уроков, интерактивные учебные материалы.

Отримано: 22.04.2019