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RESEARCH ARTICLE

Concept of Designing Multimedia Tools for The Educational Space of Dual Economic and Humanitarian Education

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ABSTRACT

The purpose of this article is to develop and substantiate a concept for creating multimedia tools for the educational space of dual economic education. The article analyzes the main problems of forming the educational space of dual education. A working student becomes more demanding with regard to the volume and format of knowledge presentation. A specialist who works and studies under dual education conditions must keep in mind a wide range of objects and subjects within the subject area of the product being created. The architecture of multimedia learning complexes (MLC) based on the competence approach is substantiated. It is proposed to use four types of knowledge, in accordance with which the elements of competencies are defined. A list of multimedia tools has been developed and their correspondence to the categories of knowledge has been determined. It is proposed that MLCs should include learner centered multimedia didactic tools created on the basis of the STEAM approach and supporting the student's activity.

INTRODUCTION

All over the world, dual education is becoming increasingly widespread, in which a student undergoes training at a university and at an enterprise at the same time. This form of training makes it possible to actualize the theoretical knowledge of university education directly in the workplace, enabling a future specialist in the field of economics to develop "in real time," and providing the enterprise with a motivated employee who becomes a bearer of the company's values and business culture (Tereshchenkova, 2014; Tereshchenkova, Bernhard, 2014). The introduction of the dual form of education aims to combine study and work in the specialty, thereby ensuring a balance between employers' current needs for workers with the required knowledge and skills and the supply of such workers (Sidakova, 2016; Vorobyeva, 2015).

However, in a certain sense, a working student becomes more demanding of the volume and format of knowledge presentation: he or she seeks to apply the knowledge and skills acquired during training; the learning process is determined by temporal, spatial, every day, professional and social factors and is organized through joint activity at all its stages (Listvin, 2016).

This contradiction gives rise to the problem of creating, in the digital environment, an educational space that differs from traditional approaches. A way of addressing the issue of effective functioning

of dual economic education is to create web-based learning in the digital space using appropriate multimedia technologies.

The lack in specialized literature of thoroughly substantiated conceptual foundations for creating multimedia tools for the educational space of dual education and for their implementation in higher education institutions in Russia makes it advisable to conduct scientific research on these issues.

Despite the fact that the activities of an entry-level specialist in economics studying under dual education conditions are predominantly technological in nature, he or she must keep in view a wide range of objects and subjects within the subject area of the product being created (Alshynbaeva, Tarantei, 2017).

An analysis of labor market development trends has shown that the activity of a student studying under dual education conditions can take place in two modes:

1. Performing homogeneous operations to create a certain type of product over a period of up to several months, if this is a sufficiently large-scale project (Nekrasov et al., 2015).
2. Carrying out project work that requires the implementation of various competencies across a multitude of short-term projects (Shauro, 2015).

In both cases, it will be very difficult to synchronize workplace training with university learning, where a number of competencies may be formed within a single semester. On the other hand, for some competencies there may be no space (project) at the workplace in which they can be acquired and applied.

Current methodological approaches to designing the educational space of dual education do not take into account the specifics and particularities of using multimedia tools. A review of the literature has shown that there is a need to further develop a concept for creating multimedia tools for the educational space of dual education within educational and professional programs (EPP), taking into account contemporary trends in both education and production.

The purpose of this article is to develop and substantiate a concept for creating multimedia tools for the educational space of dual economic education.

The main idea of the publication is based on the following hypothesis: the efficiency and quality of the educational space can be improved by implementing it through a combination of the hypertext architecture of a Multimedia Learning Complex (MLC), competence models, and learner-centered multimedia didactic tools.

MATERIALS AND METHODOLOGY

The study was conducted in the form of an analysis of the scientific literature on the chosen topic using methods of comparative analysis and synthesis, as well as abstract-logical generalization. The purpose of the study was to summarize results related to a specific research question, namely: What are the main provisions of the concept of creating multimedia tools for the educational space of dual economic education?

At the first stage of the study, information sources necessary to achieve the research aim were selected. The data for this study are represented by articles and reviews published in academic journals indexed in Scopus and Web of Science. The search was carried out using the keywords and phrases “dual education,” “economic education,” “multimedia tools,” “digital multimedia environment of higher education” in both English and Russian.

At the second stage of the study, based on an analysis of the selected scientific literature, the main provisions of the concept of creating multimedia tools for the educational space of dual education were identified.

RESULTS

The analysis of scientific studies made it possible to formulate the concept of creating multimedia tools for the educational space of dual economic education in the form of a set of provisions containing local hypotheses or statements of requirements for objects and processes within the subject area, followed by justification of each conceptual provision (Table 1).

Table 1: Main provisions of the concept of creating multimedia tools for the educational space of dual economic education

No.	Concept provisions	Sources
1	The construction of an open digital multimedia learning environment should be carried out on the basis of combining the best components of the systems and spatial approaches in the form of multimedia learning (didactic) complexes of disciplines that are interconnected and linked to Internet resources via hyperlinks.	Ryadinskaya, 2020; Zhelezko, Sinyavskaya, 2020
2	The content architecture of the educational space of an Educational And Professional Program (EPP) should be designed as a set of nested content structures with a branched network of hyperlinks.	Dudyrev et al., 2018
3	The architecture of a multimedia learning complex (MLC) has three levels of complexity in working with content (cognitive, reproductive, and creative), each of which contains a sequence of information sections that allow the degree of completeness and detail of the learning content to be increased.	Flek, Ugnich, 2020; Ignatova, Pokrovskaya, 2016
4	The creation of learning content in designing MLCs aimed at a competence-based approach should be carried out on the basis of structuring knowledge in accordance with four types of knowledge in corporate systems, modified in line with the conditions of pedagogical design of the educational space of dual education.	Pleshakova, 2019
5	In the process of designing MLC content, it is necessary to select multimedia didactic tools that make it possible to fully convey knowledge in the subject area and to form one or more competences.	Pleshakova, 2019; Yugfeld, Pankina, 2014
6	The construction of the multimedia interface of the didactic digital educational space of dual education should take into account generalized characteristics of the modalities through which students perceive learning information.	Solovyeva, 2013
7	The dynamic sequence of the material under study is structured in the following order: text → hypertext → cognitive maps → network multilayer structures (visualization of structures + text) → mind maps → text → hypermedia (links in the text to visual objects).	Dudyrev et al., 2018
8	To support the learning process in most educational programs, MLC tools should be created and used within the STEAM approach, which is a practice-oriented approach to constructing the content of education and integrates various disciplines.	Yesenina, 2015

Note: Developed by the author

DISCUSSION

When discussing the construction of an open digital multimedia learning environment based on the systems and spatial approaches in the form of multimedia learning (didactic) complexes of disciplines, interconnected and linked by hyperlinks to Internet resources (Table 1, Provision No. 1), we should note the following.

When the systems approach is implemented (educational system), the student receives information prepared in advance by the instructor and cannot influence the construction of his or her own learning path. The use of the spatial approach (educational space) makes it possible to build an open learning environment that becomes part of the student's life and allows them to seek new opportunities for self-development in the surrounding space of knowledge.

The systems approach enables the teacher, as a qualified specialist, to work through large volumes of information related to the corresponding academic subject, to systematize it, filter out unreliable information, and create various forms of presentation. The spatial approach makes it possible to structure this information and place it in the relevant sections of the multimedia learning complex, as well as to create multiple hyperlinks between the content of the MLC being developed and the other MLCs of the educational and professional program (EPP), as well as with Internet sources. This in turn provides the student with a tool for searching for new opportunities for self-development in the surrounding space of knowledge.

The provision stating that the content architecture of the EPP educational space should be designed as a set of nested content structures with an extensive network of hyperlinks (Table 1, Provision No. 2) implies that the entire educational space should reasonably be based on personal learning systems (PLS) built in the LMS Moodle environment (which is free and has a large set of tools for computer-based learning) (Zhelezko, Sinyavskaya, 2020). Each discipline has its own dedicated PLS, which includes an MLC and a number of mandatory materials such as the syllabus, course outline, and so on.

At the same time, the architecture of the MLC is based on the competence approach and learner-centered multimedia didactic tools that support the student's activity. The elements of the substantive model of competence are presented below in Table 2.

The three levels of complexity in working with MLC content, each containing a sequence of information sections that make it possible to increase the degree of completeness and detail of the learning content (Table 1, Provision No. 3), imply the following**:**

- The cognitive level contains the following sections:
- **Presentation section –** the content is presented in the form of a course presentation with frame-by-frame organization of information, where each frame contains 1–2 units of learning information presented in the form of an answer to a question, maximally structured, and for lists duplicated by illustrations;
- **Analytical section –** contains articles written in an encyclopedic style, describing ideas, approaches, educational and historical facts with hyperlinks to all materials both within the section and beyond it that are devoted to the issue in question; materials that reveal the content of the issue (presented as text, audio, and video);
- **Illustrative section –** contains examples that illustrate and explain the statements of the theoretical part; CASEs; guidance such as "What the student should notice here," "What should be taken away as a result of working with the example"; examples illustrating the result obtained in the course of the work;
- **Reference section** – contains links to information sources in print publications, electronic libraries, and websites; numerical reference information; textual reference information (for example, a list of strategies, list of positions, etc.).
  The reproductive level contains the following sections:
  Guidelines for laboratory work, practical and seminar classes;
  Testing (contains tests on the topic being studied);
  Portfolio (contains a set of typical results for the topic studied and for the discipline as a whole).

The creative level includes the following sections:

- **Micro-projects and creative tasks** – contains a list of micro-projects and creative tasks;
- **Course paper (project) –** contains methodological recommendations and examples for course papers (projects) for the course being studied or several courses, if the course project is complex or interdisciplinary;
- **Scientific problems –** contains a list of scientific problems relevant to the subject field of the EPP;
- Individual Research Tasks (IRT) – contains a list of individual research tasks.

When creating learning content in designing the MLC on the basis of knowledge structuring (Table 1, Provision No. 4), the following types of knowledge will be considered:

- **Non-formalized knowledge about activities and their results (NFK)** – answers in a non-verbal way (multimedia content) the questions: *How is this done? How is this used? How is this designed?*
- **Weakly formalized normative (operational) knowledge (WFK)** – answers through verbal tools the questions: *How is this done? How is this used? How is this designed?*
- **Conceptual Knowledge (CCK) –** answers through verbal tools the questions: *On the basis of what concept is this built? What basic idea underlies it? Which basic general scientific models characterize the phenomenon, process, or object?*

- **Systemic scientific-theoretical knowledge (SSTK)** – answers the questions: *How is this arranged? Why does it work this way? How does it affect things?*

We will match to the elements of competence those types of knowledge that can most fully implement the corresponding element (Table 2).

Table 2: Correspondence between categories of knowledge and elements of competencies

Components of competencies	**Knowledge categories**			
	NFK	WFK	CCK	SSTK
Knowledge of *what*, *how*, and *why* something happens			+	+
Knowledge of *what should be*, *how to act*		+		
Practical skills	+			
Motivation and goals of activity: *why*	+		+	
Informational image of the result of activity	+			
Understanding the broader context of the result: *where the result is applied*			+	
Ability to discuss issues related to the competence: *how to transfer knowledge of it to others*	+	+		

Note: author's development

To implement the provision on the need to select multimedia didactic tools that make it possible to fully convey knowledge in the subject area and to form one or more competencies (Table 1, Provision No. 5), a list of multimedia tools (Table 3) developed by the author can be used, in which their correspondence to categories of knowledge is established. This will allow the teacher-designer of the MLC to ensure maximally effective assimilation of learning material by students.

Table 3: List of multimedia tools for working with different categories of knowledge

No.	**Tools**	**Knowledge categories**			
		NFK	**WFK**	**CCK**	**SSTK**
Information flow to the student					
1	Presentation with hyperlinks to audio and video components		+	+	+
2	Interactive lecture				+
3	Video recording of consulting sessions	+			
4	Video clip of coaching work	+			
5	Video recording of a training session	+	+		
6	Simulation game	+	+		
7	Discipline portfolio (overall and by topics)	+			
8	Construction of texts based on the question–answer method				+
9	Video clip demonstrating the use of skills	+	+		
10	Virtual tours and video excursions	+		+	
11	Flash animation demonstrating an action, rule, or principle (law)		+		+
12	Demonstration of problem solving using the trial-and-error method		+		
13	Demonstrations of samples of research objects, images of various scientific phenomena		+		+
14	Description of the means and methods for solving learning tasks		+		
15	Presentation of information as a list of concepts, glossary, handouts (theses)				+
16	Presentation of information in the form of audio files		+		+
17	Visualization of material using flowcharts, drawings, video fragments, slides		+		+
18	Figurative representation of information using charts and graphs		+	+	+
19	Supporting notes		+		+
20	Bank of cases (situational exercises)		+		
21	Methodological guidelines for discussing situational exercises		+		
22	Bank of business games and training exercises	+	+		
23	Bank of Internet resources	+	+	+	+
24	Mind maps – content of the topic (discipline), interactive (for navigation)				+
Information flow *from* the student					
1	Student portfolio of completed tasks		+		
2	Construction of mind maps		+	+	+

3	Collection of subject-specific material on the Internet (photos, drawings)	+	+	+	+
4	Use of drawings and photos to illustrate one's own opinion	+	+	+	+
5	Preparation of an essay			+	+
6	Compilation of a list of new terms			+	+
7	Transformation of charts and graphs into textual statements			+	+
8	Answers to multiple-choice questions		+	+	+
9	Student's preparation of a plan for presenting material, with marks for sections and subsections		+	+	+
10	Discussion of scientific problems with other students and instructors		+	+	+
11	Student's recording of notes as an audio file			+	+
12	Mind maps created by the student (for summarizing acquired knowledge)			+	+
13	Workbook based on VIKI technology	+	+	+	+

Note: author's development

Taking into account generalized characteristics of the modalities of students' perception of learning information when designing the multimedia interface of the didactic digital educational space of dual education (Table 1, Provision No. 6) is based on the hypothesis of learning styles (modalities) put forward by Neil D. Fleming and Charles C. Bonwell in 1992. According to this hypothesis, four categories are distinguished that determine how learners perceive information: visual, auditory, reading/writing, and kinesthetic (Solovyeva, 2013). The features of teachers' and students' work in perceiving information in different modalities are given in Table 4**.**

Table 4: Features of students' perception of information in different modalities

Type of information perception	**Features of the learning strategy**
Visual	Preference for displaying information in the form of pictures, diagrams, flowcharts, and all symbolic lines, circles, trees, and other elements that teachers use instead of words to present information.
Auditory	This mode of perception implies a preference for receiving information "by ear." Students with this modality learn better through lectures, seminars, listening to recorded lessons, group discussions, web chats, and simply talking about the subject.
Reading/Writing	A preference for information presented in the form of words. It is no secret that many academic methods are almost exclusively geared toward this mode. The mode of perception is shifted toward textual input–output—reading and writing information in all its forms.
Kinesthetic	By definition, this modality refers to "a perceptual preference for using experience and practice (simulation or reality)." Since such a description may also be applicable to other modalities, the key is that the student is always connected to reality through experiments, examples, practice, or simulation.

Note: author's development

If the modalities of the teacher and the student do not coincide, the material prepared in the process of pedagogical design will not ensure the effective solution of all didactic tasks. Thus, the task of the pedagogical design of the MLC is to embed into the multimedia complex interactive tools that correspond to all student learning styles, and the task of the teacher is to develop recommendations (for interactive prompts) for building a learning trajectory that takes into account the modality of the learning style of a particular student working with the MLC.

To achieve this, it is necessary to embed in the MLC a testing system (for example, the VARK questionnaire) that allows the student to determine his or her modality. Alternatively, the student can undergo online testing on the VARK website, followed by integration of the assessed modalities into the construction of the learning trajectory.

The main key tasks of STEM education include (Yesenina, 2015): implementing programs for the introduction of innovative teaching methods in educational institutions; providing opportunities for students to conduct research and experimental work; organizing contests and Olympiads for self-realization; and creating information platforms. STEAM education is based on a cross-disciplinary approach.

A dual-education student, as a future specialist trained within the STEAM framework, will be able to overcome the separation from solving practical problems and build clear connections between academic disciplines.

CONCLUSION

Dual economic education, when multimedia tools of the educational space are used, will contribute to the development and improvement of the higher education system, namely:

1. it will ensure a balance between the needs of employers and university graduates;
2. it will serve as a basis for the development of a new generation of employees capable of demonstrating deep theoretical knowledge as well as skills and abilities to apply it in practice in various spheres of professional activity;
3. it will promote the revival of mentoring and the strengthening of the role of experts, which will, as a result, improve the quality of professional activity both in the sphere of education and in enterprise practice;
4. it will confirm the significance of professionals in shaping the directions of organizational learning;
5. it will make it possible to choose those forms of lifelong learning that will be of interest to young specialists, since they will provide them with material benefits and foster motivation for self-improvement.

The scientific novelty of the results obtained lies in the fact that the article proposes and substantiates a concept for creating multimedia tools of the educational space of dual education for educational and professional programs (EPP). An analysis of the specific features of dual education has been carried out, and the advantages and disadvantages of this form of education in the experience economy have been identified. Requirements for the structure and composition of multimedia learning complexes (MLC) have been formulated. Four categories of knowledge have been distinguished for forming MLC content, and corresponding multimedia didactic interactive tools have been proposed for each category. Criteria influencing the quality of MLCs have been suggested. The possibilities and limitations of implementing the developed concept for creating multimedia tools for the dual form of education in the training of future specialists have been identified and analyzed.

The practical significance of the results obtained is that they can be used in the educational process of higher education when organizing dual economic education.

The prospects for further research lie in deepening work aimed at developing concrete methods for the design and use of multimedia tools. It should be noted that in the future there is a possibility of using artificial intelligence methods to create graphical material, in particular neural networks capable of generating images from a text query, combining graphic objects, or reproducing missing elements.

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