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**PEDAGOGICAL DESIGN OF TEACHING AIDS FOR HIGHER
EDUCATION PROGRAMS ACQUISITION**

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Abstract

The article focuses on the modern aspects of higher professional education program acquisition in Russia. Besides, the existing peculiarities and requirements related to the teaching tools of future specialists as well as the results of the study of the learning process at the university during the period of distance learning are presented. Pedagogical design acts as the main tool for creating modern teaching aids for university students, which makes it possible to apply uniform principles and approaches to structuring. In the context of distance learning of higher education programs, the form of presentation of the studied information has lost its significance, the peculiarities of the perception of this information, depending on the education goals, basic education, and development conditions have come to the fore. The teaching aids that are most effectively used to achieve various goals in various conditions by heterogeneous groups of students are designated as universal. Significant characteristics of universal teaching aids were identified, such as color design of pages, font size, selection of relatively independent blocks of information. The results of the survey indicated an increase in the quality of assimilation of those materials that combined information on the topic, reference information and the maximum possible visualization in the form of pictures, drawings, diagrams, and sample tables. In modern conditions of optimization of the system of vocational education and general informatization, the content and structure ensuring adequate perception of information through the variability, the most accurate visualization of information.

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1. Introduction

1.1. Vocational education system peculiarities

The modern system of higher education in the Russian Federation includes bachelor's and master's degrees. This circumstance is aimed at ensuring and increasing the competitiveness among specialist in the labor market. The main goal of the vocational education system is to train competent specialists, who can easily adopt to modern conditions. At each training stage, students have their age, psychological, and competence characteristics, which should be taken into account by teachers when designing the educational process. The implementation of professional training of specialists at all levels of education is ensured by the continuity of goals and competencies. This makes it possible to more reasonably select the content of training, teaching aids, etc. (Nikitina et al., 2013).

1.2. Modern conditions for higher education program acquisition

The main advantage of modern training is the ability to control the learning process in the context of transition to independent design by students of their own educational path and the choice of adequate teaching aids. At the beginning of 2020, the specific features of education in all educational institutions included distance learning of a number of disciplines and activities. It turned out that the transition from traditional to distance learning is quite difficult, despite the general informatization of society in all fields of life (Abramovskiy & Rebysheva, 2020; Chotchaev, 2020; Ivanova & Murugova, 2020; Makarova, 2020; Orusova, 2020; Shmurygina, 2020). In this regard, there is a need to create modern educational process and teaching tools.

2. Problem Statement

2.1. Problem statement

Due to the fact that the living conditions of society have changed, the requirements regarding the educational process settlement are being quickly transformed. Since the middle of the 20th century, pedagogical researchers have paid attention to the fact that the educational process is constantly undergoing significant changes, while a large number of modern problems and issues of effective development of pedagogy are directly related to the digitalization of this process.

Currently, the universities have a fairly extensive base of tools and opportunities for shifting to the distance learning. This is the electronic educational environment of university with personal accounts of teachers and students, the e-mails of all participants in the process, popular instant messengers, electronic libraries, and video hosting. The information transmission channels do not require separate study. However, to transfer the discipline content effectively to the content category within a short time turned out to be a difficult task for teachers.

2.2. Theoretical prerequisites for problem solving

Taking into account modern conditions it should be stated that pedagogical design acquired special value. Pedagogical design considers the educational process from the standpoint of creating an integral system that includes the goal of learning, the material of the disciplines and the corresponding tools for interaction and translation of knowledge. The purpose of pedagogical design is to develop a system of the most adequate, comfortable and effective means and methods of the educational process. Pedagogical design, to a greater extent, considers the possibilities of effectively filling the discipline with a content component developing a logical sequence of presentation and using modern ways of presenting content (Kurnosova, 2012; Voronina, 2016).

In a broader sense, pedagogical design also involves the establishment of the learning process conditions, including the development of scenario of learning activities that will support students' motivation. At the same time, practically all teaching tools (both real and virtual) undergo transformation through the prism of pedagogical design. The use of the bases of pedagogical design in the development of digital content makes the educational process accessible, increases its efficiency, makes it possible to implement the educational process taking into account individual needs of each participant as well as the peculiarities of his/her perception, preparation, motivation, etc. The existing theory of pedagogical design does not deny the fact that knowledge is based on the experience. Thus, the learning process has to describe real conditions and, accordingly, has to correlate with real educational and professional tasks, but with the use of the capabilities of modern information and communication resources. The expansion of the theory of pedagogical design in the context of the development of educational multi-media products can be carried through the description of technology (methodological support), goals, rules for structuring the course content taking into account the levels of complexity, pedagogical methods, information tools, and principles of material acquisition control.

3. Research Questions

The teaching aids used in modern conditions were selected for the study. At the first stage of the study, it became necessary to determine the main characteristics of the subjects of the educational process in the conditions of involuntary distance learning. Based on the Kazan National Research Technological University, a study was carried out of the attitude and difficulties of teachers when transferring the content of certain types of classes to a distance mode. The area of the study was not chosen by chance. Technical sciences are the most difficult to master outside specially equipped laboratories, etc. It is relatively simple to record a lecture on video, to voice all the necessary content, but the teacher cannot see the students' response in such conditions, cannot deviate from the plan, clarify the concept, accelerate the pace if the material is well absorbed, and maintaining the interest of students throughout the lesson.

3.1. Demand for certain forms of teaching aids in the conditions of involuntary distance learning

At the initial stage of the development of teaching aid sets, the preferred forms of presentation of the material were analyzed. It was found out that among the best-comprehended material was the

following: video lectures, posted on the university website, printed textbooks and manuals posted in the electronic library systems, as well as popular instant messengers that allow feedback using images and videos due to the availability of such tools for almost all categories of citizens (Figure 01). However, according to the survey results, the lectures in different formats were singled out, which made it easier to absorb the material provided (Figure 02) and set an individual learning pace as well as optimize the search for information needed to review or fulfill practical tasks.

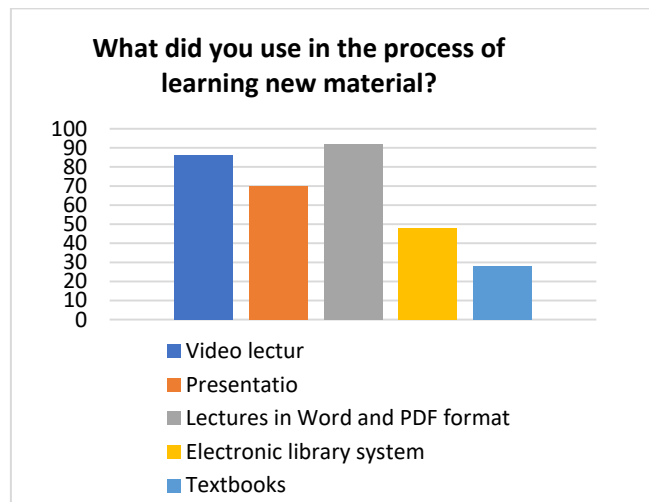


Figure 1. Diagram showing the demand for various training aids

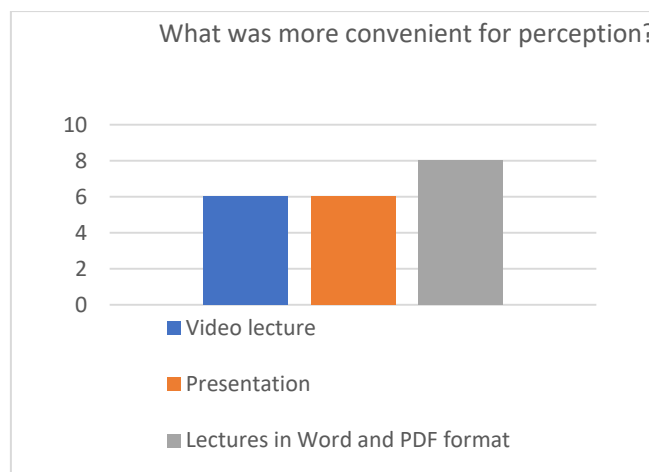


Figure 2. Diagram showing the subjective assessment of training aids by perception comfort

3.2. Unified principles to develop the effective teaching aids for engineering disciplines

The authors identified the need to use the bases of the theory of pedagogical design at the stage of course development, creating and evaluating teaching materials. It became necessary to revise and take into account the changing tasks of professional activity in connection with the new conditions of the educational process. Only the disciplinary content of teaching aids has long lost its relevance. A modern universal teaching tool should be a complex information model that ensures the implementation of the

goal of education in a system with other elements of the specialist training system. This implies certain features of the preparation of such means, which must certainly take into account the principle of continuity of the educational process. These principles should be ensured along with the compliance of the content and structure of the teaching tool with the requirements of current educational standards of the Russian Federation. The basis for the preparation of these tools should also be the principles of the progressive and cyclical presentation of the material, elements of the problem-based approach, systematic approach, ensuring the consistency and completeness of cognitive process (Gavrilova & Nikitina, 2016).

The systematic approach assumes that video and printed materials should be logically interconnected with the content of the discipline as a whole and the order of presentation of information, all means of pedagogical design should work in the system, affecting the perception of content at certain time points. Elements of problem-based approach should create situations for inconsistencies and internal conflicts in the process of studying the teaching means, forcing the student to ask clarifying questions, which will be a signal for the teacher, i.e. a kind of feedback. Cyclical nature of material presentation should be present along with consistency in order to attract the attention of students to key concepts or facts when it is not possible to use gestures and intonation.

As for the teaching aids for future bachelors, it is important to identify trends and outline the potential for the development of practical or scientific activities. The design of teaching aids for masters is based on the activity principle, that is, scientific and professional knowledge should be selected and made systematic taking into account the needs of a specific type and form of activity of a future specialist. For students enrolled in Master's trainings there is a large variability of basic training. Due to this fact, the structure of the teaching tools should provide for the allocation of enlarged blocks and topics to simplify the search for information, as well as the allocation of specific subsections for a more detailed study. Unlike teaching aids for Bachelor students, where the logical sequence of presentation and interconnection of individual topics are more important, for master students it is more important to see the enlarged structure of the discipline and a detailed consideration of individual issues. If all these features are taken into account, it is possible to create an optimal universal teaching tool that will be used as efficiently as possible by future bachelors and future masters.

It is advisable to develop the structure of teaching aids on the basis of a modular approach with the allocation of relatively independent blocks with maximum visualization and enlarged presentation of basic concepts.

3.3. Effective universal learning tools features

Studies have shown that the greatest difficulty for teachers was the lack of this feedback and the retention of students' attention. Although the lecture did not lose its content, under the new conditions it turned into a simple broadcast of information. At first glance, it is impossible to change this situation; however, the means of pedagogical design are capable of transforming the perception of distance learning not only among teachers, but also among students. It does not matter if we talk about tutorials, textbooks, video lectures, presentations, or about some kind of interactive content in the educational environment. When creating complex courses, the use of traditional methods in the early stages inevitably resulted in an unjustified increase in the time spent.

When using any teaching aids in the conditions when personal presence in the classroom is not possible, the elements of psychological knowledge are important as well as the knowledge of pedagogical theory. Here, such little things as the color design of pages or slides, font size, the selection of relatively independent blocks of information, the style of lexical structures, the speed of presentation, the presence of interactivity, etc. come to the front line.

4. Purpose of the Study

The purpose of the study was to theoretically substantiate the design process of effective universal teaching aids and their practical testing in the changing conditions of the educational process. To do so it was necessary to solve the following tasks: to select the forms of teaching aids that are in demand in the changing conditions; to develop effective universal teaching aids taking into account the identified principles and characteristics; to test the developed teaching aids in the changing conditions of the implementation of the educational process.

5. Research Methods

The solution of the tasks was carried out through the use of theoretical research methods, such as a system analysis of psychological and pedagogical literature; a comparative analysis of teaching aids and regulations in the field of the educational process and the level of professional training of specialists; modeling and generalization, and empirical research methods (questionnaires, interviewing, educational process observation, methods of mathematical statistics).

6. Findings

In the course of the study, the authors developed video lectures and textbooks for university students enrolled in the engineering fields, which were structured taking into account the modern needs of the educational system functioning in the conditions of a distance university educational process and taking into account personal interest of students in continuous high-quality professional training.

The video lectures were developed taking into account the specifics of future professional activities. Their design was based on the presentation in order to focus not on the appearance of the lecturer, but on the information. Some typos and inaccuracies were deliberately allowed in the text, which should have caused certain questions from students, whose absence signaled the student's inattentive study of the material. Pedagogical design aids were also used in the design of presentations: the arrangement of text on a slide, color and video design, the number of new concepts per lecture, moments of maximum conscious perception alternated with the information that was easier to master.

The lecture material was selected in accordance with the degree of complexity of perception. The simplest questions remained for independent study, and the most difficult ones were brought out in a video presentation, the complication of topics progressively proceeded from the beginning of the study of the discipline to the end. Within the content, a cyclical return to each new concept was ensured. The study showed that this form is most convenient for the university students.

The tutorials were structured on the basis of a modular approach with the allocation of relatively independent blocks with maximum visualization and an enlarged presentation of the basic concepts. The structure also incorporated the cyclical nature of the disclosure of basic concepts. Moreover, the connections between the concepts were revealed throughout the entire block from topic to topic. The structure also incorporated the cycle-based nature of the disclosure of basic concepts.

Thus, when drawing up the structure of a teaching tool intended for relatively independent development of topics by a student, in accordance with the theoretical foundations of pedagogical design, at the first stage, it is necessary to highlight the key concepts surrounded by additional information. This number of concepts should be small. Besides, it should include both the accepted in the scientific community concepts and the concepts of new scientific directions or related to foreign experience.

Moreover, problem-based lectures that require conscious perception, a creative approach are recommended to be delivered separately at the end of the course when a student already has enough knowledge to independently identify problem areas in the video content, determine ways to solve the problem, and form new knowledge based on their own conclusions. The teacher provided a control task at the end of the lecture, the implementation of which would be impossible if the student did not cope with the described stage of the problem lecture perception.

Distance learning of the educational programs has revealed a number of additional opportunities for students. A large number of teachers recorded video lectures using various video hosting sites. It is known that in order to ensure the training of a modern competent specialist who is ready to carry out multifunctional professional activities, it is necessary to include sections related to professional sphere trying to break the “artificial boundaries” between various specialized areas in the content of textbooks. The analysis carried out among Master’s students shows that a fairly large number of Bachelor’s graduates wish to continue their studies in the Master’s program in related domains or other areas of training that are not related to the education they have already received. These students need to study the process of various product design of light industry in the shortest time. Their Master’s studies can be devoted to various aspects of professional activity (Gavrilova & Nikitina, 2016). Thus, some of the Master’s students or applicants for Master’s degree studies could additionally master a number of disciplines necessary for further education. It was enough for the teacher to make a list of lectures recommended for watching and help determine the questions that had to be studied. Thus, the educational program has expanded its variability by reducing the student’s time spent on “attending” traditional lectures.

7. Conclusion

Thus, it was concluded that in modern society the optimization of vocational education system and general information technology, the design of the educational process by means of pedagogical design is extremely in demand.

Nowadays pedagogical design is becoming a mandatory, effective tool for the professional activity of a higher school teacher, without which it is impossible to transform the content of a discipline into a new format that is accessible, understandable, timely, modern and adequate to the trends in the development of public life in general.

Modern means of communication, mostly Internet communications, have made significant changes in all spheres of human life, from changes in the fundamental structures of consciousness (emotions, memory, imagination, rationality) to the needs of a modern person. Today it is an open question if it is possible to keep up with the progress and pace of changes in social life and the intensive development of technology. Therefore, the basic principles of structuring the content and teaching aids of a course within the framework of the theory of pedagogical design can be effectively applied in the field of vocational education, regardless of the specific situation. It is not of great importance what the form of the teaching tool is (online or offline). Modern Internet communications ensure its availability almost anywhere in the world in various formats, the presence and development of electronic library systems also contribute to this. Thus, in the development of the teaching aid systems, their content and structure come to the front line, ensuring adequate perception of information through variability and the most accurate visualization of information and objects of professional activity.

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