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Research Article

Methodology For Organizing Independent Education Of Students Of Higher Educational Institutions In Subjects Related To Computer Graphics

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ABSTRACT

This article identifies the existing problems in the training of information technology specialists in higher education institutions and provides feedback on their elimination. Additionally, this article presents appropriate methods for teaching computer graphics and enhancing students' motivation to produce various graphic projects. It emphasizes the development of creative and cognitive thinking based on several factors related to the selection of forms and development of didactic teaching tools. The article also analyzes the current state of independent learning organization for students and proposes a three-stage structural model for offering independent educational tasks in computer graphics-related disciplines, which are offered as a professional subject in the training of future IT specialists in higher education institutions. This article proposes and recommends the use of a three-tiered structure and model, as well as develops criteria for assessing students' independent learning assignments. At the same time, it presents an analysis of experimental pedagogical work aimed at determining the effectiveness of the proposed structure and model in organizing independent training for future specialists in information technology in the field of computer graphics. The results of the experimental research were analyzed mathematically and statistically, based on the Student-Fisher test and the validity of the hypothesis proposed.

Keywords: Information Technology, Computer Graphics, independent work, structure, model, reproductive, productive, creative, experimental-testing, student-Fisher

Introduction:

Today, digital technologies are utilized in all sectors. Due to the extensive adoption and enhancement of computer graphics applications, there is a requirement to enhance the training system for skilled professionals in this domain. Given the significance of computer graphics tools in the creation of diverse landscapes, advertisements, gaming, animation effects, instructional materials, and other applications, it is essential to ensure that professionals possess the necessary skills and knowledge to utilize these technologies effectively. [1, 2].

However, despite the significant role of computer graphics in the development of students' thinking abilities in information technology, there is a lack of attention given to its full potential in some cases. Therefore, it is essential for students to possess a solid foundation in information technology in order to make optimal use of computer graphics capabilities for future professional endeavors. For example, students should develop the skills necessary to independently create various graphic projects based on their creative ideas within this software environment in order to fully utilize the potential of computer graphics.

Therefore, there is currently a need to enhance the forms, approaches, and tools for training future information technology professionals in higher education institutions, including those specializing in computer graphics.

II.Overview of sources of literature, literature review:

One of the primary objectives of higher educational institutions is to train specialists in accordance with the demands of the times and to foster their personalities capable of self-directed and innovative growth. [3]. When performing these tasks, it has been found that it is difficult to accomplish them simply by transferring knowledge from the instructor to the student in a pre-packaged form. Future specialists require training that will allow them to transition from being passive recipients of knowledge to active creators of knowledge, who are able to formulate problems, analyze possible solutions, find optimal outcomes, and prove their correctness. [4]. When implementing these measures, it is efficient to employ independent training for future specialists. Hence, today, special attention should be given to the organization of such training, particularly for specialists in information technology.

The ongoing research projects also aims to address these issues, specifically, enhancing the independent training of future IT specialists in computer graphics disciplines through the use of advanced educational technologies.

It is understood that for computer graphics-related subjects, the self-study component of the curriculum also includes topics in the syllabus based on the number of hours allocated, and these are focused on independent study in accordance with current requirements. However, it must not be overlooked that the primary purpose of independent work is to build and develop the knowledge, skills, and abilities necessary for future professionals to independently complete a specific educational task under the guidance and supervision of an instructor. In this context, according to D.T. Yakhtibayev, independent learning should involve not simply reviewing the topics covered but also exploring additional information related to the field, fostering their activity and independence as personal traits, and developing mental skills, creativity, and investigative abilities. [4].

It has been argued by U.M. Mirsanov [3], A.O. Nurbekov [5], D.R. Ruzieva [6], E.V. Boikov [7], I.M. Vlasova [8], and I.A. Petrova [9] that independent education plays a significant role in enhancing the effectiveness of computer science and information technology teaching in higher and in developing students' digital competence.

These scholars consider independent learning to be not just a mode of learning, but also an essential component, as it performs a variety of functions and fosters the development of certain skills and abilities in future IT professionals [6,10]:

- developing;
- Informational and educational;
- Guiding and stimulating;
- Education and research.

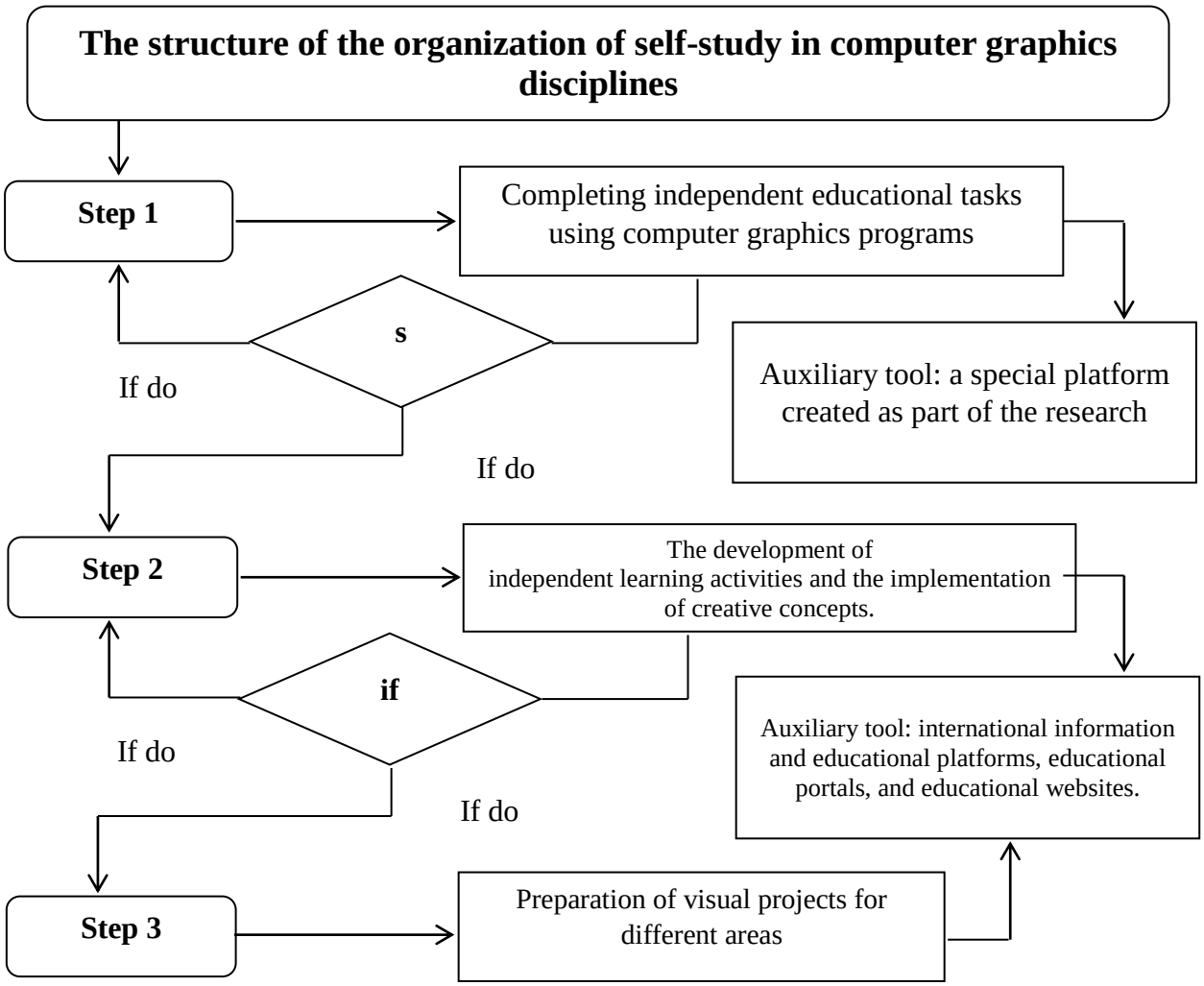
The future of information technology is to enhance the culture of intellectual work and the creative activity of professionals in applied and technical computer programs, as well as the development of intellectual capacities. [8, 3, 5, 6]. The "information and education" component includes educational activities for future information technology professionals in the classroom. [6]. "Guiding and stimulating" ensures the professional orientation of the educational process [11; 66-b.].

III. Materials and methods.

While the aim of the educational component – information technology – is to shape and develop the professional skills of specialists, the research component forms a new level of professional and creative thinking with modern computer hardware and software. [7, 8, 9, 6, 12,13].

Thanks to these features, effective training for future specialists in information technology is achieved, preparing them for professional activities.

The current research also addresses these issues. Specifically, it aims to improve the methodology for organizing self-study training for future professionals in the field of information technology and computer graphics. This is considered an essential component of the training process for these professionals. Within the scope of this study, we have developed a three-tiered structure for organizing students' independent study in subjects related to computer graphics. (look at the 1st picture).

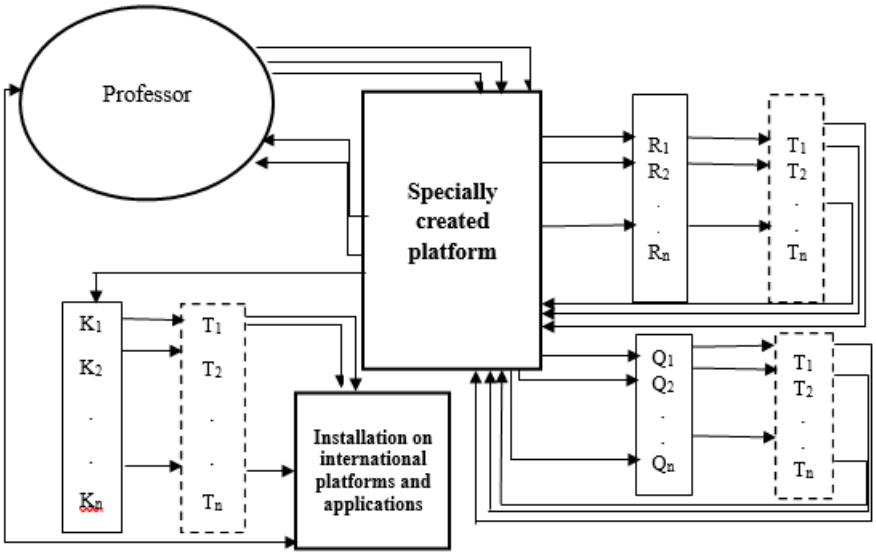


1st picture. The structure of the organization of self-studying in subjects related to computer graphics of students

The proposed structure provides for three stages of independent training for future specialists in information technology, specifically in the area of computer graphics. At the fisrt stage, students are tasked with performing independent educational assignments using computer graphics software. These assignments involve complex graphic projects and exercises in creating animation effects. If students successfully complete the first stage's tasks, they are eligible to proceed to the second stage, students prepare more comprehensive practical projects based on their independent learning experiences.

These projects aim to implement creative concepts and ideas. Once completed, these projects are transferred to the third and final stage. The third stage involves preparing visual projects tailored for various applications. These projects can be designed for different fields or industries. By completing this stage, students demonstrate their skills and knowledge in computer graphics, making them well-prepared for future careers in related fields.

The organization framework for these proposed three-stage tasks is presented below. (look at the 2nd picture).



2nd picture. The model for the organization of self-studiyings from subjects related to computer graphics of students

Here $R_1, R_2, ..R_n$ means reproductive and productive level assignments, $Q_1, Q_2, ..Q_n$ means partially traceable level assignments, $K_1, K_2, ..K_n$ means creative level assignments, $T_1, T_2, ..T_n$ represents the student to whom the assignment was sent. These three-stage assignments are submitted and accepted by teachers to students via specially created platforms.

As examples of the proposed three-stage task structure: $R_1, R_2, ..R_n$ - namely the reproductive and productive levels, we can cite the following: through these tasks in the first stage, future information technology specialists will perform practical assignments on topics outlined in the curriculum. At the same time, they will be able to apply the theoretical knowledge acquired through lectures and develop practical skills gained through laboratory work. As examples of the proposed three-stage learning objectives, namely, reproductive and productive levels, the following can be cited: Through the completion of the first set of objectives, future information technology specialists will be able to perform practical tasks related to the topics outlined in the curriculum. These tasks are designed to help students apply their theoretical knowledge from lectures in a practical context and develop their practical skills through laboratory work. For example, in the topic "designing various objects using 3D graphics software", students will complete projects that require them to use 3D graphic design programs to create and manipulate digital models. This activity allows students to apply their knowledge of 3D design principles and techniques in a real-world setting.

After successfully completing these $R_1, R_2, ..R_n$ introductory assignments, future IT professionals will be provided with assignments $Q_1, Q_2, ..Q_n$ that are partially at the research level. An example of this would be the development of graphical applications for complex web interfaces. At the same time, the motivation and development of the creative thinking of future IT specialists will be enhanced through the creation of web animation effects, varied words, images, videos, and various illustrations and applications in various formats. Future IT specialists $R_1, R_2, ..R_n$ are given challenging assignments $Q_1, Q_2, ..Q_n$ after successfully completing lower-level ones: $K_1, K_2, ..K_n$. $K_1, K_2, ..K_n$ – The objectives of the course should focus on the development of research skills among future professionals in the field of information technology. As an example, it is suggested to provide examples of tasks such as "creating complex graphic models for freelance authors" [14]. Simultaneously, future specialists in information technology will possess skills related to creating 3D models, techniques for producing and presenting animated effects, and the sale of proprietary software solutions. Therefore, when assessing the independent educational task described above, i.e., the three-stage (reproductive, productive, and creative) level of student achievement, it would be advisable to employ the following formulas:

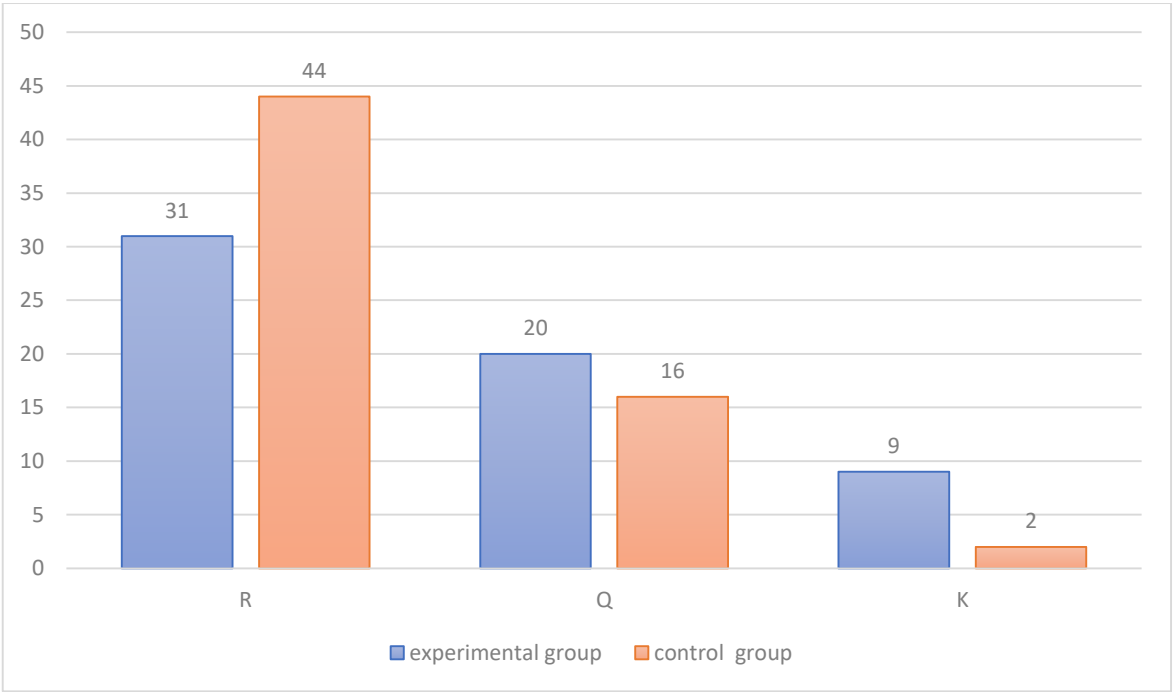
a) $90 < (R_1 + R_2 + .. + R_n) + (Q_1 + Q_2 + .. + Q_n) + (K_1 + K_2 + .. + K_n) < 100;$

b) $70 < (R_1 + R_2 + .. + R_n) + (Q_1 + Q_2 + .. + Q_n) < 89;$

c) $60 < (R_1 + R_2 + .. + R_n) < 69;$

IV.Analyses and results.

Experimental work was conducted to determine the effectiveness of the developed structure for assessing the independent learning tasks of future information technology specialists. The study involved students from higher education institutions specializing in information technology. A total of 122 students from the educational direction "Information Systems and Technologies" were involved in the study, who were divided into two groups: experimental (60 students) and control (62 students). The experimental group received independent educational tasks based on the structure and model proposed within the study framework, while the control group did not receive this opportunity. Within the context of this experiment, the findings of students enrolled in the educational program "Information Systems and Technologies" have been analyzed and a mathematical and statistical assessment based on the student-Fisher's criterion has been conducted in order to validate the reliability. When using this criterion: $\overline{X} = \frac{1}{n}\sum_{i=1}^{4} n_i X_i$, $D_n = \sum_{i=1}^{4} \frac{n_i (x_i - \overline{X})^2}{n-1}$ a formula was used to calculate the average values, variance coefficients, and development indicators for the sample. The formula: A % $= \frac{\overline{X}}{3} \cdot 100\% - \frac{\overline{Y}}{3} \cdot 100\%$ was used to determine the appropriate values for the sample based on the given criteria. Based on the results of the calculations, it has been determined that the average rate of growth in the experimental group exceeds that of the control group by 10.4%, as shown in Figure 3, which illustrates the dynamics of growth for the experimental group.



3rd picture. Experimental-test acquisition dynamics

V. Summary:

Therefore, it is important, using the structure and model proposed within the framework of this study, to organize independent training for future specialists in information technology, focusing on disciplines related to computer graphic programs. At the same time, this training aims to guide future IT professionals in systematizing, categorizing graphics knowledge, developing creative abilities, and creating individual graphic projects relevant to academic research. The competence of these IT professionals will also be enhanced through the creation of various original graphic projects based on their own creative ideas, achieved through independent research efforts.

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