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Scientific article

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Research of the methodology for the development and implementation of a teaching and methodological complex for graphic training

Abstract. Modern changes in the field of education are aimed at improving the quality of training engineering personnel. One of the key components of this process is the improvement of the methodological support of the educational process. The article discusses the importance of developing educational and methodological complexes (EMC) and their role in training students of technical universities, as well as the introduction of modern technologies into educational practice. Particular attention is paid to EMCs in engineering graphics disciplines such as «Descriptive Geometry» and "Engineering Graphics and Computer Design". The creation and use of EMCs helps to improve the quality of education, improve students' perception of complex theoretical materials, develop their spatial imagination, mathematical and computational skills. The article provides an example of a successful EMC developed at the Department of Engineering Graphics and Information Technology of the Tashkent Institute for Design, Construction and Operation of Highways, as well as the use of animation technologies to improve the perception of education material. The presented results confirm the importance of introducing EMCs into the educational process to improve the effectiveness of education. The issue of improving educational and methodological complexes in disciplines is relevant from the point of view of the quality of mastering educational programs by future specialists and, as a consequence, achieving effective results in the training of highly qualified personnel. The article examines the problem of improving and developing a methodology for creating and

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methodological complexes that play a key role in the process of graphic training of engineering personnel.

Key words: educational and methodological complex, design, educational process, dynamic video, animation fragment, descriptive geometry, engineering graphics.

Introduction

The modern education system faces numerous challenges, including the need to improve the quality of training specialists. In particular, for engineering universities, the improvement of methodological support for the educational process plays a special role. In the context of rapid technological development, the introduction of innovative teaching methods that combine traditional and modern approaches is becoming an integral part of educational practice. An important aspect is the creation and use of educational and methodological complexes (EMC), which include not only traditional textbooks and manuals, but also electronic materials, as well as methods that promote the active perception of knowledge by students.

The EMC system is a set of tools aimed at improving the independent work of students, developing their motivation and improving the quality of assimilation of educational material. Based on modern technologies, it is possible to create interactive manuals, including animation videos and models, which greatly simplifies the perception of complex subjects, such as descriptive geometry and engineering graphics. The introduction of EMC allows not only to increase the effectiveness of teaching, but also to improve the general training of students, which is important for the training of qualified engineers.

Materials and methods

The methodology of this study is based on a systematic approach to the analysis and improvement of the teaching and methodological support of the educational process in technical universities. The main research methods are:

1. Analysis of existing methodological materials and educational technologies - to identify weaknesses in current approaches to student training and to formulate recommendations for their improvement.

2. Experimental method - was used to test various components of the educational and methodological complex (EMC) in the process of teaching the disciplines of engineering graphics and descriptive geometry.

3. Case method - a study of practical examples of the implementation of EMC in the educational process, such as the development and use of animation and computer technologies to improve the effectiveness of learning.

4. Qualitative and quantitate evaluation methods – collection andanalisis of data on 3 the results of using the EMC among students, including their perception and level of mastering the material.

5. Comparative analysis –comparison of traditional teaching metods with the use of modern technologies (animated videos, CAD and other computer tools).

6. Modeling the educational process – creation and analysis of models demonstrating the effectiveness of introducing various technologies into the educational process.

These methods allow identifying key problems associated with student learning, as well as offering effective ways to solve them through the introduction of modern educational tools.

In the process of reforming the education system, higher education teachers conduct consistent research to improve the quality of training engineering personnel. One of them can be considered the improvement of the system of methodological support for the educational institutions, development based on modern technologies that combine traditional and modern methods of organizing the educational process, embodied inn progressive ideas based on scientific and technological achievements.

In the course of studying the issue of improving the system of methodological support for the educational process, one can pay attention to the following aspects of theoretical and practical significance:

-managing independent activities of students;

-forming students' motivation;

-defining the tasks of teaching aids in the educational and methodological complex;

-modeling the content of educational materials and the use of models in training.

Results and Discussion

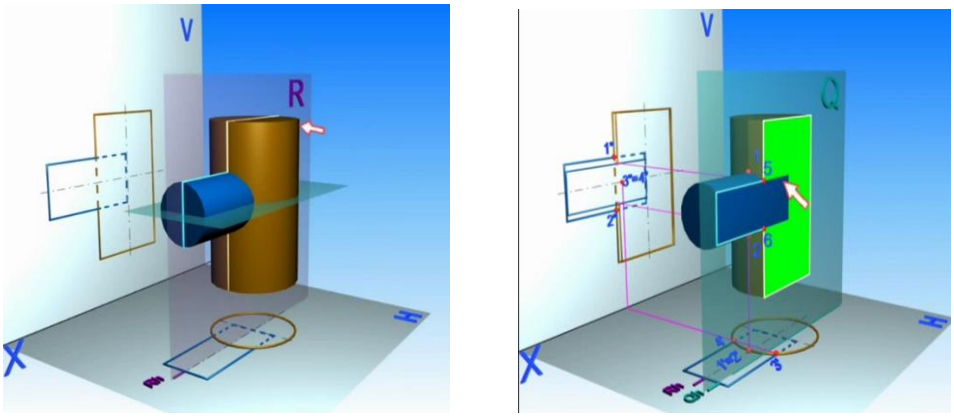
The results of the study show [1] that in the high-quality mastering of educational programs by future specialists and, as a result, in achieving high levels in the training of comprehensively formed, developed personnel, the issue of improving educational and methodological complexes (EMC) in academic disciplines is mainly of great importance. The relevance of the study of the methodology for developing and implementing teaching and methodological kits in teaching disciplines lies in the fact that the creation of a set of modern educational tools and various methodological materials, as their use, well increase the efficiency of the training process for future specialists. At the same time, the need to study this problem lies in the fact that the creation of teaching and methodological kits for graphic education also allows teachers to increase the efficiency of their teaching activities.

Textbooks and teaching aids, additional literature and tasks selected on the basis of a unified approach and comprehensive review reveal the content of the subject and strengthen the practical focus of the course. A well-thought-out private methodology allows mainly young teachers to quickly adapt to the peculiarities of the subject and teach students highly effective learning. The importance of creating and using teaching and methodological kits for the module «Descriptive Geometry» in engineering universities (and in foreign ones as well) lies in the that to study this subject, at least a little spatial imagination is necessary, as can be seen that indicator is very low by almost 70% among applicants [2]. For successful assimilation of complex educational materials on this subject by first-years students, various methodological and methodological tools are necessary, allowing to quickly eliminate existing shortcomings in the knowledge acquired at school.

The introduction of the teaching and methodological complex will njt only improve the quality of independent work of students, but will also help students improve logical thinking, form and develop spatial imagination, mathematical computational skills, and develop other professionally important features. The study of the activities of the teaching staff of technical universities in the development and application of the teaching and methodological complex shows that a certain positive experience has been accumulated in this area. In order to

further improve the development and use of the teaching and methodological complex, the Development of Engineering Graphics and Information Technology of the Tashkent Institute for Design, Construction and Operation of Highways developed the teaching and methodological complex, which took 1st place in the competition for the best quality of the teaching and methodological complex, held among departments. This teaching and methodological complex consists of two components that interact with each other. The first component was created for the module " Descriptive Geometry ", and the other – for the module " Engineering Graphics and Computer Design." The finished UMK includes 12 teaching aids, which are usually available on paper and electronic media. It also includes various electronic teaching materials containing animation fragments of the assembly process of various assembly units based on modern software packages
(AutoCAD, 3DMaxStudio and Flash). Dynamic videos developed on the basis of animation fragments display the process of assembly and processing of units in the module "Engineering graphics and computer design".

The teaching and methodological kit developed for the module "Descriptive Geometry" consists of a short illustrated text of lectures, a collection of metric and positional problems on all topics of the module, as well as questions covering complex geometric issues. The text of the lecture includes two-dimensional and three-dimensional color graphics images that accurately and clearly explain the essence of the material prepared and with the participation of students using CAD programs for each topic of the module. Two-dimensional and three-dimensional animations developed for most topics facilitate the display of the relationship between geometric objects and various situations between them, a complete analysis of the object being studied, which leads to easier mastery of the subject by students (Figure 1).



Future 1- Fragments of an animation video on constructing a line of mutual intersection of two cylinders using the 3DMaxStudio system

The skillful use of electronic teaching methods, such as writing lecture notes, which takes a lot of time. The main point of this approach is that the student should write notes on the subject at home, not in class, read it and prepare for the lesson, and in class it is advisable to the teacher. Also in this style, if the teacher lost two academic hours on one traditional lecture, now he will be able to save at least half of this time. In this case, students turn their attention to the projector screen. This process is two-way , useful, that is at the beginning of the lesson, students will be given handouts in the form of problems, the solution of which will be synchronized based on animation fragments displayed on the projector screen (Figure 2).

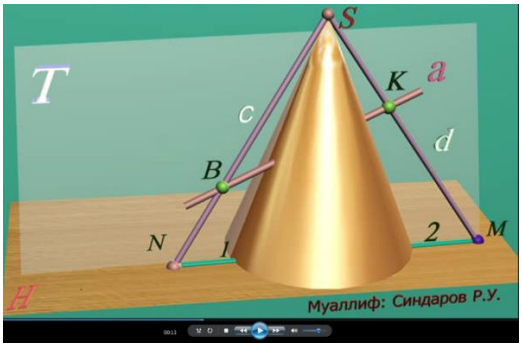


Figure 2- Fragment of an animation video on constructing interesting points of a straight line witch a cone using the 3DMaxStudio system

In this case, unlike problems solved on the board in the traditional way, the teacher will be able to either pause the process of demonstrating the solution to the problem, or go back, or repeat, as a result of which the students will better perceive the educational material and will be ready for practical classes on the subject. With active perception and understanding by students of the materials being studied, it is very important that the teacher develops the ability to present materials in a lively, interesting way. The timely use by the teacher in classes of colorful and technically controlled two-dimensional and three-dimensional animation fragments (videos) with high quality design are very attractive and perceived by students (especially for the 1st year) with great interest (Figure 3).

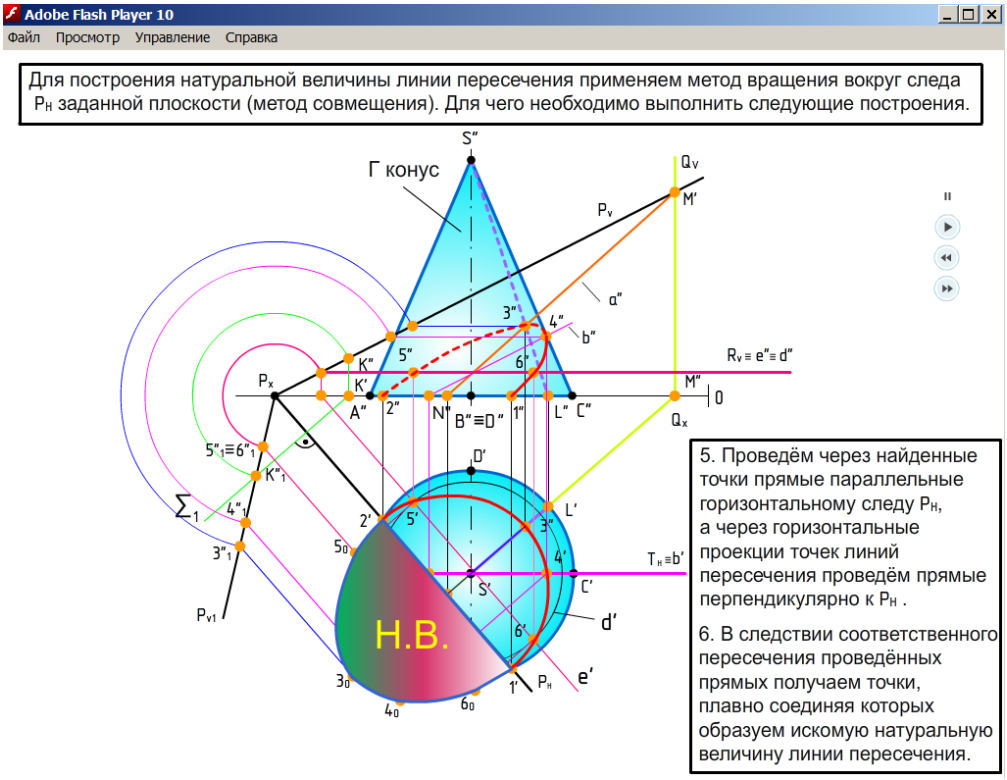


Figure 3 – Fragment of an animation clip on constructing the intersection line of a plane with a cone using the Flash program

In general, computer-based learning is a powerful motivational tool that personalizes the learning process and emphasizes its personal orientation. To a certain extent, the motivational factor that causes additional interest in education is the computer itself. It is known that engineering graphics in technical universities is an important component of the national preparatory process and forms the basis of the classical technical and vocational education system of a future specialist [3]. The educational and methodological complex, developed according to the module «Engineering Graphics and Computer Design», has a teaching aid on mechanical engineering, many teaching aids and instructions, a set of tasks for performing projection drawings of parts, for each of which a three-dimensional computer model was created in the AutoCAD program. In addition, using the 3DMaxStudio computer program, animation videos were developed for a detailed study of the assembly drawing (Figure 4).

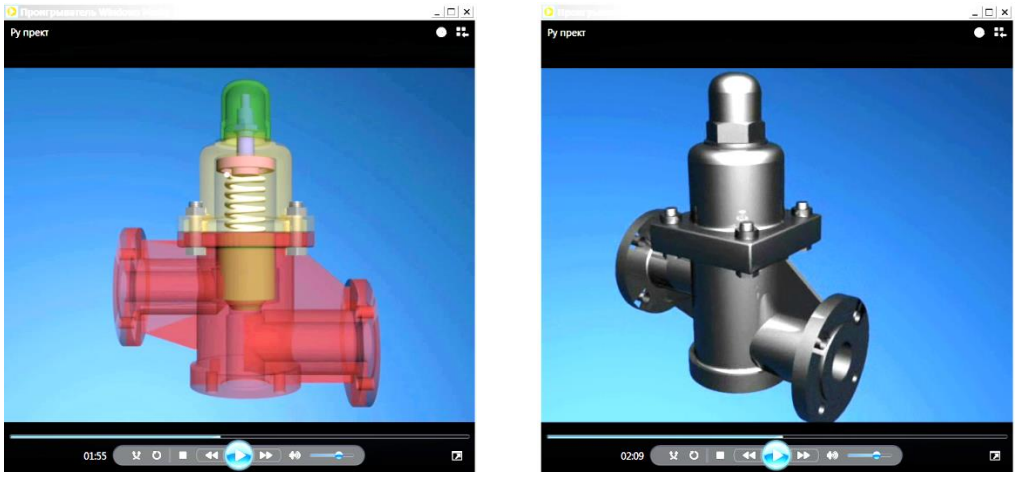


Figure 4 – Fragments of an animation video on the assembly of a bypass valve, created using AutoCAD and 3DMaxStudio systems

In developing this teaching and methodological kit, we have envisaged the following objectives: methodological support for the process of teaching students to work with intelligent computer automated design systems CAD; simplification of the process of understanding and comprehension of the basics of drawing geometry

and engineering graphics of students using the capabilities of computer modeling, taking into account the lack of time; optimization of the work of teachers of graphic qualifications of future specialists and ensuring that graduates of technical universities meet the qualification requirements imposed by the society on information technology; effective use of methods for providing educational materials using computer technologies and electronic educational literature; application of methods for improving independent work of students and the use of tests that allow a comprehensive assessment of the level of training of future specialists.

However, we believe that the existing positive experience of creating a teaching and methodological complex [4] still requires deep scientific analysis, optimal design of the process of teaching students various subjects, scientific justification, generalization of methods for developing and using educational materials. At the same time, the main attention should be paid to methodological support of the educational process in higher educational institutions and such aspects of teaching academic disciplines, in particular, justification of qualification requirements for training specialists, development of electronic textbooks and teaching aids, introduction of modern interactive teaching methods, improvement of testing methods, etc. [5].

To summarize, we can say that the study of the methodology for creating and using the teaching and methodological complex of graphic training is one of the urgent scientific tasks, and therefore at present, along with the knowledge that has constituted the fundamental basis of the curriculum for many years, a lot of new knowledge is formed in them as an invariant, which requires teachers to regularly make methodological and dynamic changes to the existing teaching and methodological complex. Therefore, when teaching the subject of engineering graphics and computer design, teachers must deeply master the methodology of developing and applying teaching and methodological kits [6].

Discussion

In the process of studying the improvement of methodological support for the educational process, especially in technical universities, the key element is the use of educational and methodological complexes (EMC). The main aspects that require

attention include managing students' independent activities, forming their motivation, and modeling educational materials. The development of EMC allows combining traditional teaching methods with innovative approaches, such as the use of modern technologies, including computer programs and animation [7].

One of the striking examples of the successful use of EMC is the development of a complex that includes both theoretical materials and practical tasks created using AutoCAD and 3DMaxStudio software packages. These tools contribute to a better understanding of complex topics such as geometry and engineering graphics, and also allow students to develop critical skills in spatial thinking and modeling. The effectiveness of such approaches was confirmed by the example of the Tashkent Institute, where the developed EMC took first place in the competition for the best quality of the educational and methodological complex. In addition, the use of teaching and methodological complexes allows to reduce the time spent on preparing and conducting classes, as well as to increase students' attention, providing them with the opportunity to interact with the educational material at a deeper level. Animated fragments and 3D models create a vivid and understandable idea of complex graphic tasks, which contributes to faster mastering of the material.

Conclusion

The introduction of teaching and methodological complexes (TMC) in the process of training specialists in engineering universities is a necessary step to improve the quality of education. The development and use of TMCs in key disciplines, such as «Descriptive Geometry» and «Engineering Graphics», can significantly improve the perception and assimilation of complex theoretical and practical materials by students. The use of modern technologies, such as computer modeling and animation videos, contributes to the development of important professional skills, such as spatial imagination and mathematical thinking.

The creation and implementation of TMCs in the educational process significantly increases students' motivation, improves their independent work and contributes to the effective mastering of academic disciplines. However, to further improve the learning process, it is necessary to continue scientific research aimed at optimizing the development and application of teaching and methodological kits, as

well as introducing new interactive teaching methods. It is important that teachers of engineering disciplines not only master these technologies, but also actively apply them in their teaching practice, which will ensure a higher quality of training of future specialists.

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Графикалық оқытудың оқу-әдістемелік кешенін жасау және енгізу әдістемесін зерттеу

Аңдатпа. Білім беру саласындағы заманауи өзгерістер инженерлік кадрларды даярлау сапасын арттыруға бағытталған. Бұл процестің негізгі құрамдас бөліктерінің бірі оқу үдерісін әдістемелік қамтамасыз етуді жетілдіру болып табылады. Мақалада оқу-әдістемелік кешендерді (ОӘК) әзірлеудің маңыздылығы және олардың техникалық жоғары оқу орындарының студенттерін оқытудағы рөлі, сондай-ақ білім беру тәжірибесіне заманауи технологияларды енгізу қарастырылған. «Сызба геометрия» және «Инженерлік графика және компьютерлік дизайн» сияқты инженерлік графика пәндері бойынша оқу-әдістемелік жинақтарға ерекше назар аударылады. Оқу-әдістемелік жинақтарды жасау және пайдалану білім сапасын арттыруға, оқушылардың күрделі теориялық материалдарды қабылдауын жақсартуға, олардың кеңістіктік қиялын, математикалық және есептеу дағдыларын дамытуға ықпал етеді. Мақалада Ташкент автомобиль жолдарын жобалау, салу және пайдалану институтының инженерлік графика және ақпараттық технологиялар кафедрасында әзірленген табысты оқу-әдістемелік кешеннің мысалы келтірілген, сонымен қатар оқу материалын қабылдауды жақсарту үшін анимациялық технологияларды қолдану. Ұсынылған нәтижелер білім берудің тиімділігін арттыру үшін оқу-әдістемелік кешендерді оқу үдерісіне енгізудің маңыздылығын растайды. Пәндер бойынша оқу-әдістемелік кешендерді жетілдіру мәселесі болашақ мамандардың білім беру бағдарламаларын меңгеру сапасы және соның нәтижесінде жоғары білікті кадрларды даярлауда тиімді нәтижелерге қол жеткізу тұрғысынан өзекті болып табылады. Мақалада инженерлік кадрларды графикалық оқыту процесінде шешуші рөл атқаратын оқу-әдістемелік кешендерді құру және пайдалану әдістерін жетілдіру және дамыту мәселесі қарастырылған.

Түйін сөздер: оқу-әдістемелік кешен, дизайн, оқу процесі, динамикалық, анимациялық фрагмент, геометрияның сипаттамасы, инженерлік графика.

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Исследование методики разработки и внедрения учебно-методического комплекса графической подготовки

Аннотация. Современные изменения в сфере образования направлены на повышение качества подготовки инженерных кадров. Одним из ключевых компонентов этого процесса является совершенствование методического обеспечения учебного процесса. В статье рассматривается важность разработки учебно-методических комплексов (УМК) и их роль в обучении студентов технических вузов, а также внедрение современных технологий в образовательную практику. Особое внимание уделено УМК по дисциплинам инженерной графики, таким как «Начертательная геометрия» и «Инженерная графика и компьютерное проектирование». Создание и использование УМК способствует повышению качества образования, улучшению восприятия студентами сложных теоретических материалов, развитию у них пространственного воображения, математических и вычислительных навыков. В статье приводится пример успешного УМК, разработанного на кафедре инженерной графики и информационных технологий Ташкентского института по проектированию, строительству и эксплуатации автомобильных дорог, а также использования анимационных технологий для улучшения восприятия учебного материала. Представленные результаты подтверждают важность внедрения УМК в учебный процесс для повышения эффективности обучения. Вопрос совершенствования учебно-методических комплексов по дисциплинам актуален с точки зрения качества освоения образовательных программ будущими специалистами и, как следствие, достижения эффективных результатов в подготовке кадров высшей квалификации. В статье рассматривается проблема совершенствования и разработки методики создания и использования учебно-методических комплексов, играющих ключевую роль в процессе графической подготовки инженерных кадров.

Ключевые слова: учебно-методический комплекс, проектирование, образовательный процесс, динамический фильм, анимационный фрагмент, начертательная геометрия, инженерная графика.

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