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Didactic Opportunities of Information and Communication Technologies in Graphic Training of Future Technology Teachers

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Abstract: *Purposeful use of information and communication technologies (ICT) in drawing lessons provides an opportunity for the complex attraction of various forms of sensual and rational cognition for comprehensive study and thorough assimilation of the essence of the studied objects and phenomena; formation of the scientific style of thinking of students; development of creative abilities of future specialists; improving the efficiency of the educational process, etc.*
The purpose of the article is to explore the didactic capabilities of ICT tools in the process of graphic training of future technology teachers in drawing lessons.
It is established that the effectiveness of using ICT in the process of graphic preparation of students is achieved only with the use of special software. In this regard, according to various classification features (didactic goals; basic architecture; branches of scientific knowledge; functional purpose) the analysis and systematization of the software the tools that can be used in the process of graphic training of future technology teachers in drawing lessons. It presents the practical experience of systematic use of didactic capabilities of software of various types in graphic preparation of students (educational presentations, electronic databases, electronic directories, controlling software) as well as the general characteristics of modelling software, including computer-aided design systems (ArchiCad, AutoCad, SolidWorks, T-Flex Cad, COMPASS), which have become the most widespread in graphic preparation of students. The authors reveal functional possibilities and didactic significance of the COMPASS program in the process of studying geometrical, projection, machine-building, schematic and construction drawings. The article presents the results of the implementation of ICT tools (including the COMPASS program) in the process of graphic training of future teachers of technologies.

Keywords: *information and communication technologies; software; practical experience; educational process; drawing lessons; development of creative abilities.*

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Introduction

The defining feature of modernization of the education system is the development of new educational tools that integrate the achievements of pedagogical science with the modern didactic potential of information and communication technologies (ICT).

The didactic capabilities of ICTs and the global computerization of educational institutions determine the objective prerequisites for the systematic use of e-learning in domestic educational practice. The use of ICT in the educational process, in particular in higher education, determines the revision of its main components (goals, content, forms and methods of educational activities), puts forward new requirements for the training of teaching staff and their role in this process.

Theoretical and methodological foundations of creation and use of electronic learning tools are covered in scientific works of V. Volynskyi (2005), Y. Zhuk, & O. Sokoliuk (2004), L. Zabrodska (2004), V. Lapinskyi (2004) et al.

In their scientific and methodical works R. Hurevych, & M. Kademiia (2006), M. Zhaldak (2004), E. Mashbits (1988), Y. Ramskyi (2013) and Yu. Shpylovyi (2015) highlighted didactic possibilities of using ICT for the realization of actual educational tasks in educational institutions of different level. The scientists set the requirements for the initial software, explore the psychological features of the creation of educational software, highlight the issues of how to use ICT in the study of different disciplines.

Various aspects of professional training of future technology teachers using ICT were researched by I. Halahan (2015) (use of electronic educational and methodological complexes) (2015), M. Marhitych (2015) (formation of information and technological competences), O. Torubara (2007) (formation of readiness for use of information technologies), M. Yashanov (2010) (use of electronic educational resources) and others.

The problem of using ICT in graphic training of university students was covered in the scientific works of A. Hedzyk (2011) (preparation of the future technology teachers for the course of the technical drawing), G. Raikovska (2011) (graphic training of technical students), S. Kovalenko (2011) (formation of graphic competence of the future civil engineers), M. Koziar (2012) (graphic training of future engineers in the field of water management) (2012), M. Yusupova (2010) (interactive teaching graphic disciplines in higher technical education) et al.

Among foreign researchers, it is necessary to distinguish the works of T. Burton, G. Bertoline & S. Wiley (1992) – development of visual

perception using computer engineering graphics, M. Omar, D. Ali, M. Mokhtar & A. Abdullah (2018) – use of the virtual environment and augmented reality to support engineering education and enhance visualization skills, C. Reffold (1998) – computer-oriented teaching of engineering technical drawing, O. Shteymark (2008) – improving the quality of pedagogical university students' knowledge of digital educational resources et al.

At the same time, in practice, the didactic capabilities of ICT are not always properly taken into account and used, in particular in the process of graphic training of future teachers of technologies. Extra research is required for the problem of the didactically expedient use of functional capabilities of various types of software, including computer-aided design systems (ArchiCad, AutoCad, SolidWorks, T-Flex Cad, COMPASS, etc.) to solve the educational tasks of graphic preparation of students at the lessons of technical drawing.

The purpose of the article is to explore the didactic capabilities of ICT tools in the process of graphic training of future technology teachers in drawing lessons.

Materials & methods

Achieving this goal was ensured by the systematic use of a complex of scientific and pedagogical methods of research. In particular, the following were used: analysis of scientific, educational and methodological literature, dissertation works – to establish the degree of elaboration and prospects of the studied problem; comparison – to compare alternative scientific views on the problem under study; synthesis, generalization and systematization of practical experience of using ICT in the process of graphic training of future technology teachers in higher educational institutions.

Characterization of didactic capabilities of ICT tools in the educational process

An important feature of the ICT use in the educational process is the provision of opportunities to manage the educational and cognitive activities of all subjects. Accordingly, there are the following types of management and their stages:

1. Direct management of the students' educational and cognitive activities by the teacher: a) the teacher offers the student a choice of the educational task; b) student requests are only allowed for a solved study

assignment; c) the nature and amount of assistance that a student can receive using a computer are determined by the teacher based on an analysis of the results of his / her activities to accomplish this task.

2. Indirect management by the teacher: a) the teacher sets the student with a problem based on which he independently formulates the educational task; b) modelling tasks for different systems are used with the limitless number of solutions allowed to solve them; c) educational influences are presented in the form of heuristic recommendations and generalized evaluations of the student's activities.

3. Dynamic management by the teacher and the student: a) the educational task is formulated by the teacher or student; b) the student solves the problem, using a computer to perform only certain (clearly defined by the teacher) stages of the solution; c) the nature and extent of assistance in solving the problem can be determined either directly by the student or the teacher (depending on the educational situation).

Didactically justified use of ICT in the educational process makes it possible to intensify the intellectual abilities of the subjects of learning, exercising significant influence on the course of thinking processes of the individual (memory, imagination, attention, thinking, etc.), as well as emotional and motivational spheres of activity (Holiver, 2005, p. 47). Also, the use of ICT from the neurophysiological side is consistent with the principle of broad involvement of the gnostic units of the highest levels of the nervous system (cerebral hemispheres) in the acquisition of new knowledge, that is, in this process simultaneously involving visual, auditory and kinesthetic analyzers against the backdrop of attracting general attention interest with a clear motivation for learning. Such simultaneous expansion of the range of irritations of the analyzer systems increases the volume of those specific (speech) links of human memory, which ensure the functioning of higher levels of thinking (Berezan, & Berezan, 2006, pp. 4–5).

The use of computer graphics provides visual support for the training material. The combination of on-screen text, audio and graphical information contributes to the formation of stable representations of the studied objects, processes and phenomena, which makes them easier to memorize. Graphic dialogue in the system «man – computer», allowing to manipulate not only values, but also arbitrarily constructed dynamic images of situations and processes, develops not only the imagination, but also the thinking of the person, as the latter learns to compare sign and figurative representations of situations, to form generalizations of the highest order (Mashbits, Andrievskaya & Komissarova, 1989).

ICT tools enable the development of students' abstract thinking, as they enable them to gain a holistic view of the content of vocational training, and by facilitating the symbolic representation of objects and phenomena of the surrounding reality, facilitate the development of logical and imaginative thinking of future professionals (Kondratova, 2005).

Classification of software and the possibility of their use in the process of graphic training of future technology teachers at the lessons of technical drawing

Many software products on the software market can be used successfully in the process of graphical training for future job training teachers for the technical drawing lessons. Let us briefly dwell on their classification. For didactic purposes, V. Volynskyi (2005) proposes to classify the software with their distribution into information-explanatory, educational-training, controlling and combined. At the same time, according to the specifics of the presentation of the educational material and its educational value, the software is divided into electronic reference books, electronic textbooks, electronic tutors, electronic educational-methodical complexes, etc. By feature, the software is classified according to the fields of scientific knowledge and academic subjects for which they are intended, e.g., the software for the study of chemistry, geography, technical drawing (Volynskyi, 2005).

According to the didactic functions, the software is distinguished (Nyshchak, 2008):

1. Software tools for assimilation of theoretical information – issued in a measured amount and orient the educational process following the students' intellectual abilities.

2. Controlling software tools allows the teacher to organize and carry out pedagogical control aimed at identifying the level of academic achievement of students, as well as to carry out a statistical analysis of the success of the subjects of learning.

3. Demonstration software provides a refinement of the educational process, supplementing the educational information with illustrative material of static or dynamic nature.

4. Training software is focused on the formation, refinement and consolidation of relevant students' skills, including graphics.

5. Game software enables the organization of students' educational and cognitive activity in a game form and provides control over its progress.

6. Simulation and modelling software is designed to model (simulate) real processes and phenomena of objective reality. Such software includes a wide range of tools for comprehensive study (exploration) of virtual models that can provide educators with ample opportunity to manage the learning activities of the learning subjects.

7. Diagnostic software provides the teacher with the opportunity to diagnose the individual abilities and psychological characteristics of students, identify the causes of erroneous activities (decisions) of the subjects of learning, establish the degree of intelligence, awareness in a particular field, etc.

Many years of practical experience of systematic use of software in the graphic training of future technology teachers(especially at technical drawing classes) at Drohobych Ivan Franko State Pedagogical University proves their broad didactic possibilities for activating students' cognitive activity. Thus, theoretical material from the course of technical drawing, in parallel with the explanation of the teacher is periodically accompanied by the demonstration of educational presentations (video materials), aimed at familiarizing students with technology and modern production, the design process (creation of technological and design documentation). When using multimedia tools, future technology teachers can watch the technological processes on the screen including the processing of structural materials, the process of manufacturing parts, the operation of machines and mechanisms. In particular, when studying kinematic circuits students see in dynamics the process of transmission of motion using belt, chain, gear, friction, rail and other types of gears, get acquainted with the construction of their elements (stars, chains, gears, gears, worms, rails, worms, rails, gears. shafts, axles, etc.). This activates the thinking activity of students as they operate in the imagination of spatial images of kinematic elements, matching them with the corresponding symbolic (conditional) notation, reproducing in their memories the basic information, modelling the dynamics of their work. Such educational activity of students promotes a better understanding of the principles of functioning of technical systems, allowing them to expand knowledge about the basics of modern material production.

In the process of graphic training of future technology teachers in drawing classes, work with electronic databases containing samples of student graphic works, images of typical parts of machines and mechanisms, drawings of structural elements of details (chamfers, grooves, tumbles, stiffeners, ledges, centre holes, etc.), standards, directory information (thread tables, surface roughness, tolerances and landings, etc.). The use of digital artwork samples is an effective visual material in the study of machine-

building drawing, helps students to better understand the technological processes of manufacturing parts, their purpose and principle of work in complex technical systems.

Working with electronic directories provides students with proper study of the main sections of the drawing course (geometric, projection, machine-building, schematic, construction), allows to organize the more effective independent activity of future teachers of technologies, aimed at search, mastering and practical application of the necessary theoretical knowledge, expanding the range of their engineering and graphic knowledge.

Controls (KTCNet, MyTest, Test Reader) are used to detect the level of graphic knowledge of students, the strength of mastering the theoretical provisions of the drawing course, the requirements of the standards for creation and design of graphic documentation. The controls can test a large number of participants (students) in quite a short time. In this case, the results of the audit can be stored as separate accounting files, information from which can be recalled at any time on the monitor screen or printed on paper.

In the process of graphic training of future technology teachers at the lessons of technical drawing, the most widespread were modelling software means, including computer-aided design systems (ArchiCad, AutoCad, SolidWorks, T-Flex Cad, COMPASS, etc.), the systematic use of which promotes the development of spatial and students' imaginative thinking, especially in the study of projection drawing, when the process of creating visual images of depicted spatial objects and their interpretation and image on the plane cause significant difficulties of thinking nature. By operating on the monitor screen a three-dimensional image (model) of a spatial object, students can view it from all sides (angles) to become fully acquainted with the geometric shape and to form representations of the corresponding spatial images with their subsequent image on the format plane. Using computer-aided design, students create three-dimensional models of technical objects of any complexity. This provides the possibility to create associative drawings of modelling objects that can instantly reflect any changes in the design or shape of the model.

Let us give a general description of the most common modelling software – computer-aided design systems that can be used at the technical drawing classes:

1. ArchiCad is a professional graphical software package for architects used for construction work. The functionality of the program provides the design of architectural and building structures, elements of the landscape, the development of project documentation, as well as drawings

and three-dimensional models of buildings and structures. As experience shows, the ArchiCad program can be partially and fairly successfully used in the process of acquaintance with future construction teacher training in construction drawing. When working with the software, students easily create typical building drawings, in particular floor plans, sections of buildings, facades (main, yard), drawings of individual building structures (eaves, ceilings, floors, etc.); get the necessary information about the premises (area, height, location of sanitary equipment, etc.). Productive is the work of students with the ArchiCad library, which has more than 600 parametric elements of building structures, which, if necessary, can be easily modified according to the set design tasks.

2. AutoCad is a popular multifunctional 2D and 3D computer-aided design and technical drawing system that allows all kinds of design work to be done – from concept development to working documentation. AutoCad makes it easy and simple to perform 3D models of technical details of any complexity. This provides the opportunity to create appropriate associative drawings of the model, which can automatically react to any changes in its shape or size.

In the process of graphic training of future teachers of technologies, AutoCad can be successfully used to familiarize students with an engineering drawing. In particular, it is advisable to use a software tool to analyze the structural design of technical objects, represented in the form of virtual 3D models, the execution of work drawings, sketches, drawings of assembly units, etc.

3. SolidWorks – a software complex for automation of the industrial enterprise at the stages of design and technological preparation of production. SolidWorks is a powerful tool for 3D modelling and computer-aided design of complex products for various purposes. In essence, it is a complete set for designing products in digital form, which contains a large number of additional tools for implementation of the model of virtual technical tests.

Among the main features of SolidWorks, we should single out the following possibilities: hybrid parametric modelling (solid-state modelling, surface modelling, frame modelling) of any complexity; designing of products taking into account specificity of their production (details from plastic, sheet material, molds and dies of metal construction, etc.); design of three-dimensional assemblies of assembly units (technical structures); ability to work with circuits; availability of design libraries (library of typical structural elements, standard parts and units; a library of physical properties of materials, etc.); the possibility of animation of finished products, etc.

4. T-Flex Cad – an innovative hybrid parametric design system that combines the functionality of 2D and 3D design; has powerful tools for creating parametric and non-parametric drawings of parts and assemblies, as well as design documentation.

The software has extensive functionality in 3D modelling, which makes it possible to design a variety of technical objects. In this 3D model, one can easily draw and design respective drawings, create views, sections and sections of the modelling object. As the shape and size of the 3D model are changed, the drawings created on its base are automatically updated. Similarly, when the original images are resized, the 3D model itself will be updated on the model drawing.

In the T-Flex Cad, all elements of the virtual model are linked by their corresponding parameters and geometric relationships (parallelism, perpendicularity, tangency, etc.). Due to its wide range of tools, the T-Flex Cad has been successfully used to solve any design challenge in various industries (engineering, instrumentation, machine tools, construction, etc.).

5. COMPASS – a powerful system of automated three-dimensional design, which is used to automate various types of design and construction work in the field of mechanical engineering, architecture and construction. The main components of the program are a parametric 3D modelling system, a drawing editor, and a special module for designing specifications. A key feature of the software product is to provide end-to-end design process from the implementation of the idea in 3D to the preparation of a complete set of documentation.

COMPASS is a multi-window and multi-document computer-aided design system. It can simultaneously process different types of documents – three-dimensional models, drawings, fragments of drawings, text-graphic documents and specifications.

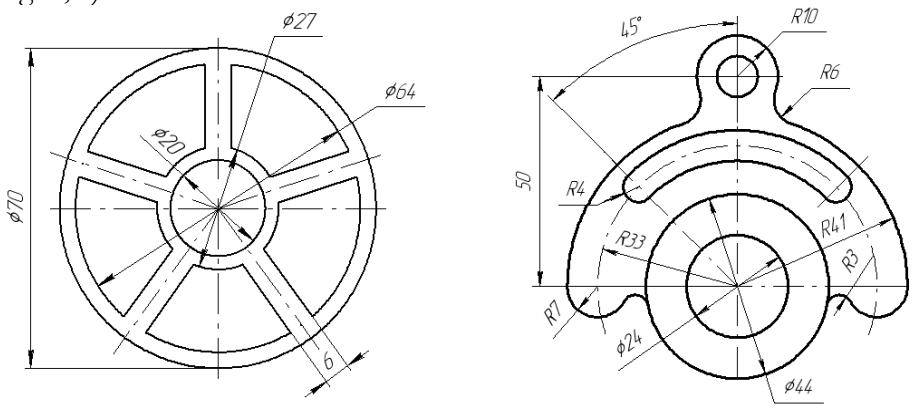
Through the use of the COMPASS tools, students can create three-dimensional models of technical parts and units, assembly units containing both typical and non-standard structural elements. At the same time, information about the geometry of 3D models can be transferred to various software packages, as well as to be used to create the appropriate design and graphic documentation.

Practical experience of using the COMPASS program for the realization of educational tasks of graphic training of future technology teachers at the lessons of technical drawing

Due to its powerful functionality, simple and clear interface, accessibility in development and free license (for educational version), the COMPASS software has become widely used in the process of graphic training of future technology teachers at Drohobych Ivan Franko State Pedagogical University.

In the process of studying geometric drawing students use the COMPASS program for automated execution of the simplest geometric constructions (dividing segments, angles and circles into an equal number of parts; contouring of objects with elements of conjugation; drawing tangent lines; constructing a slope and taper, etc.).

Fig. 1 presents fragments of drawings of technical details, made in the COMPASS using tools that provide automated separation of circles into an equal number of parts (Fig. 1, *a*) and the construction of smooth transitions (conjugations) between the lines of the contour of the object (Fig. 1, *b*).



a) *b)*

Fig. 1. The result of the students performing graphic tasks in geometric drawing in the COMPASS environment

Studying the topic «Marking Dimensions in the Drawing», students use special COMPASS tools for drawing linear, angular, radial and diametric dimensions, as well as special symbols. In this case, all dimensions are automatically calculated taking into account the scale of the drawing and dimensional numbers together with the dimensional and outline lines placed in the image of the object following the current requirements of the

standards. It speeds up the process of marking sizes, improves the accuracy and quality of graphic work of students.

In the process of the acquaintance of future technology teachers with the basics of rectangular projection and varieties of images of objects in the drawing, it is advisable to use the tools of COMPASS to automate the construction of basic views (frontal, horizontal, profile), cuts (simple and horizontal, full and vertical; and inclined) and cross-sections (rendered, superimposed) of spatial objects on the plane.

Fig. 2 shows a complex drawing containing three projections of the object and its visual image (rectangular isometry) with a cutout of a fourth part. The main image (front projection) contains a combination of half of the view and half of the corresponding section of the object.

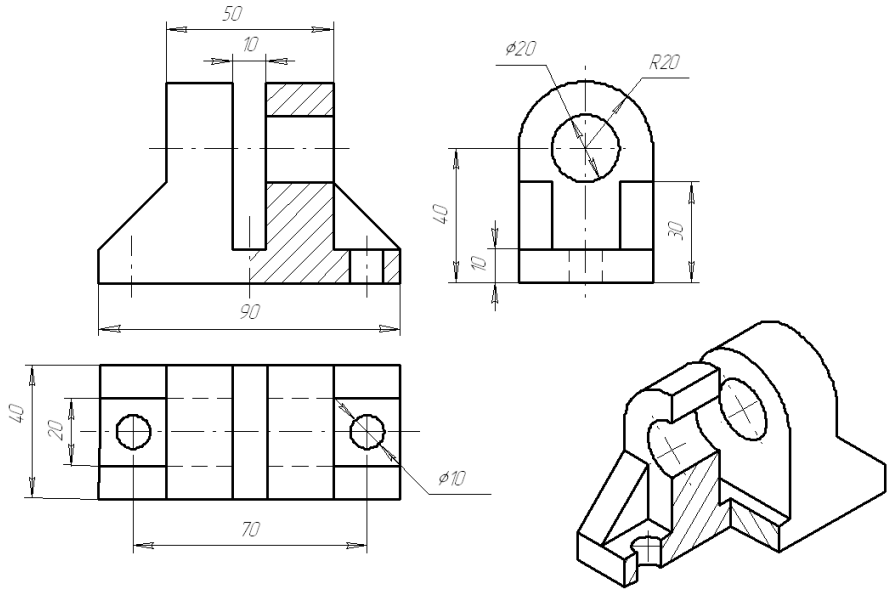


Fig. 2. Comprehensive drawing of the object and its visual image, made in the COMPASS

It is advisable to use COMPASS software when the students study the basic types of connections. The use of the library manager, in particular the library of fasteners, allows the presetting (setting of diameter, length, thread parameters, etc.) and the automatic cutting out of any fastener (bolt, nuts, screws, washers, pins, etc.), used in mechanical engineering. This speeds up the execution of the design and graphic documentation, especially the assembly drawings.

In the process of studying machine-building drawing, the students have the opportunity to use the means of parametric modelling of the COMPASS program, which provide the possibility of automated creation (generation) of images of technical objects (assembly units) of any complexity based on their three-dimensional models, previously developed in the 3D editor. At the same time, to create working or assembly drawings, the generated images of the three-dimensional model must be refined: additionally applied dimensions with marginal deviations, surface roughness symbols, other information necessary for the manufacture, control or operation of the technical object.

Fig. 3 depicts a three-dimensional model of the roller and a fragment of a working drawing generated on its basis and supplemented with the necessary information.

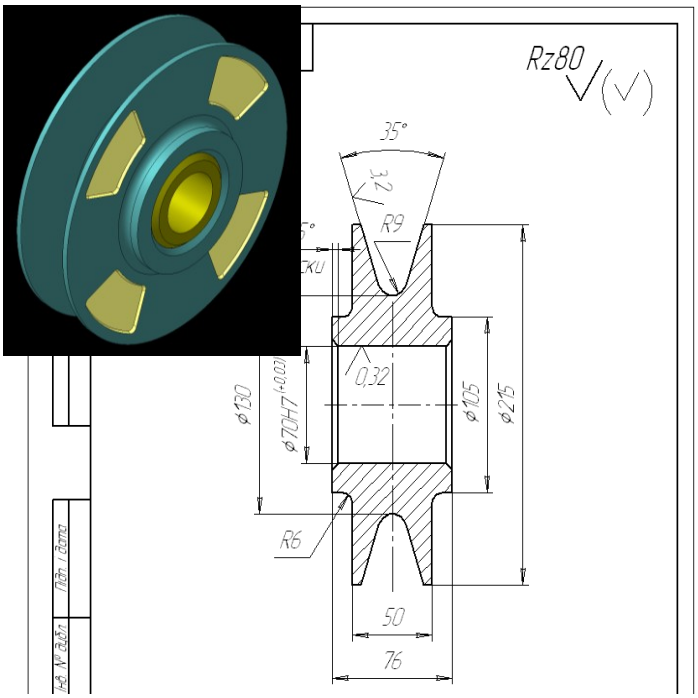


Fig. 3. Three-dimensional model and a fragment of the working drawing of the roller, created using the COMPASS program

The COMPASS program can also be successfully used as visual aids training material at the lessons of technical drawing. In particular, based on previously created three-dimensional models of technical details

(mechanisms, machines), it becomes possible to acquaint students with their purpose, structure and conditions of operation.

Fig. 4 shows a three-dimensional model of the guide block in the assembled and «spaced» views, demonstrating its structure and method of combining parts of the product.

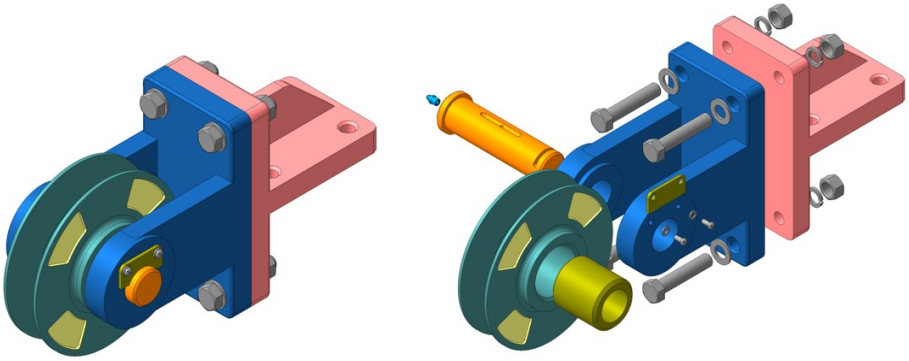


Fig. 4. The three-dimensional model of the block of the guide, created using COMPASS

When introducing students to the schematic drawing, it is advisable to use the standard COMPASS libraries that allow one to automate the process of creating technical schemes of different kinds (kinematic, hydraulic, electrical, etc.) and types (structural, functional, principle, etc.). In particular, with the help of the library of elements of kinematic circuits, it becomes possible to automatically cross out the notations of mechanical gears (gears, belt, chain, friction), mechanisms (ratchet, Malta), kinematic pairs, links, couplings, bearings, etc. The use of a standard pneumatic and hydraulic circuit library facilitates the process of delineating the pneumatic and hydraulic fittings (valves, throttles, valves, pumps, etc.). At the same time, the standard library of elements of electrical devices automates the process of creating electrical and radio circuits.

During the execution of construction drawings (facades, plans, sections of buildings and structures) students actively use instrument tools of the standard library «Construction, engineering networks and communications», which allow the automatic drawing of elements of architecture (doors, windows, partitions, stairs, etc.), sanitary equipment, systems of ventilation, heating, air-conditioning, etc.

Due to the systematic use of ICT tools (including the COMPASS program) in the process of graphic training of future technology teachers at Drohobych Ivan Franko State Pedagogical University, Vasyl' Stus Donetsk

National University, Taras Shevchenko Regional Humanitarian-Pedagogical Academy of Kremenets, Khmelnitskyi Humanitarian-Pedagogical Academy, T. H. Shevchenko National University «Chernihiv colehium», Chernihiv during 2015-2018, a gradual improvement in the quality of students' academic achievement was recorded, especially the intermediate stage of pedagogical diagnosis (2016-2017 years).

Results

The diagram (Fig. 5) shows the dynamics of qualitative changes in the level of graphic training of future technology teachers who studied the course of technical drawing using ICT tools, including the COMPASS program.

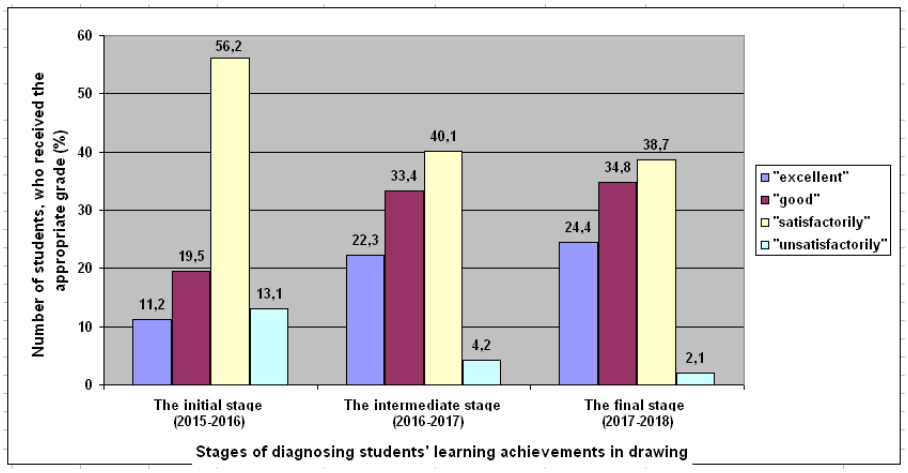


Fig. 5. Dynamics of qualitative changes in the level of graphic training of students, implemented by ICT

Discussion and Conclusions

The leading tendency of informatization of the education system is the introduction of new learning tools and methods, focused on the active use of information and communication technologies. Modern ICTs have a strong didactic potential with a wide range of opportunities for organizing and implementing the educational process. They cause changes in learning technologies making it possible to improve the level of education of employees in the educational sector.

According to N. Holiver (2005), information and communication technologies of training are a set of techniques and tools of computer

engineering used for educational purposes, as well as a set of educational and methodical materials necessary for their successful use in the educational process. This scientific position is shared by S. Ovcharov (2003), who understands ICT as a set of hardware, software and information tools needed for the implementation of educational activities.

In our opinion, the most complete interpretation of the definition of «information and communication learning technologies» was proposed by M. Zhaldak (2004). The scientist believes that ICT in class is a system of modern methods of creation, editing, storage, processing and transmission of educational and cognitive information using modern information and technical means, aimed at improving the educational process and increasing its effectiveness (Zhaldak, 2004).

The introduction of ICT in the educational process causes the restructuring of the cognitive activity of the individual and enhancing his intellectual capacity.

According to Y. Mashbits (1988), ICTs have become a fairly effective tool for teaching in the arsenal of modern educators, as they allow:

– significant expansion of the ability to present educational information, in particular through the use of colour, graphics, animation, sound, video equipment;

– increase of the motivation of learning, which provides the ability to regulate the complexity and difficulty of learning tasks, atypical presentation of a learning problem, timely obtaining the necessary assistance with additional clarification of the correct solution of the problem, «tolerance» of the computer to possible failures in learning, etc.;

– active involvement of students in the educational process, conditioned by the possibility of individualization of educational and cognitive activity, establishing feedback, choosing the optimal pace of work, etc.;

– expansion of the system of training tasks related to modelling of various production situations, troubleshooting, planning of educational actions. It provides the opportunity to evaluate the optimality of the solution found and the effectiveness of the chosen strategy of action, constant control over the educational activities of students (students), etc.;

– the flexibility of management of the educational process, which is ensured by a clear fixation and analysis of the nature of possible mistakes of students (students), forecasting ways of their elimination and corresponding adjustment of educational activity;

– formation of reflection of own educational and cognitive activity, conditioned by the possibility of visual presentation of its results. In this

case, computer training systems can not only report the correctness of the task but also predict the positive and negative moments of the selected action strategies with the characteristic of the most common mistakes.

Didactically justified use of ICT in the learning process, according to V. Zhukova (2013), contributes:

– to optimize the study time required for the study of the discipline;

– to establish feedback between all participants in the educational process;

– to organize the students' extra-curricular activity aimed at assimilation of educational information using the necessary information resources;

– to make a shift towards individualization of learning, which is ensured by managing completeness and the way of presentation of the educational material and the rate of its assimilation depending on the individual capabilities of each student;

– to intensify the educational and cognitive activity of students, which is conditioned by an unconventional approach to presentation and ways of solving educational tasks;

– to form the skills of analysis and decision-making in non-standard (non-typical) educational situations;

– to organize a quick, objective and impartial review of students' educational achievements;

– to assist teachers to solve topical tasks of didactic and organizational-methodical character.

The effectiveness of the use of ICT in the educational process is achieved only with the availability of specialized software, focused on solving specific didactic tasks. Therefore, from a pedagogical point of view, for successful implementation of ICT in the process of graphic training of future teachers of technologies, it is necessary to dwell on the functions of the respective software rather than the functions of the hardware component.

Thus, in the course of the scientific and pedagogical research, we have identified, studied and substantiated didactic possibilities of using ICT in the process of graphic training of future teachers of technologies.

The purposeful use of ICT tools at the lessons of technical drawing provides an opportunity for comprehensive involvement of various forms of sensual and rational cognition to comprehensively study and thoroughly assimilate the nature of the objects and phenomena under study; formation of a scientific style of thinking of students, focused on the knowledge of the laws of objective reality, in particular in the process of working with

information tools that allow simulation of processes and phenomena; developing creative abilities of future professionals, in particular in the process of research and development using ICT; improving the effectiveness of the educational process, in particular by increasing the degree of individualization of students' educational activities, etc.

Due to its wide functionality and considerable didactic potential to provide graphic training for future technology teachers at the lessons of technical drawing, it is advisable to systematically use simulation software – the computer-aided design system COMPASS.

The prospect of further scientific research is the study of the problem of creation and use of narrowly-targeted pedagogical software in the educational process, focused on the complex implementation of didactic tasks of graphic training of future teachers of technologies.

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