International Conference «Global Science and Innovation»

May 21-22, 2014

USA, Chicago

DIDACTIC SYSTEM AS A MEANS OF FORMATION OF COMPETENCE

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Abstract

In this paper we consider the place and role in the formation of didactic software information and professional competence of students, as well as six types of situational production problems have a direct impact on this process.

Keywords: computer programs, interactive environments, competence, didactics, e-learning, situational problems, visual information, computer modeling, computer graphics, technological process, system knowledge.

One of the basic tasks of creating information and professional competency (IPC) - to teach students to work with new information, constantly update their knowledge, increasing the level of information - project training for solving complex situation-production tasks, based on information modeling.

Implementation of didactic conditions allows each student to deal not only with the complete system knowledge, but also with a variety of complex (situation-production) tasks, from which new knowledge should be able to get. This involves the formation of an independent competence in the selection of conflicting data (quality improvement and cost reduction products) and formulation of the problem (need to find a value of constant time at which the concentration of the solvent in the resin composition to be within acceptable limits), formulate hypotheses (increased hardener composition glue will accelerate the process of bonding the veneer), creating a model (including, and computer), check its adequacy (check the adequacy of the analytical and empirical models of the process of mixing products) research model (find the optimal values of the reaction rate), the transfer of results obtained using mathematical modeling of the real object (using an analytical model for modeling the process of cleansing the air in the shop); the experiment with the real object (experimental determination of the strength of the plates), to draw conclusions.

The basis of the didactic provision for future specialists IPC formation are:

- situation-production tasks of different types: according characterization of cognitive activity (production technology of slabby materials, cutting slabby materials, replacement of equipment, etc.); on the content of subject (making analytical models of technological process (TP); on functions of the

educational process (formation of competence in solving complex situation-production tasks); on the content of actions (search for TP optimal modes);

- system of creative tasks on compilation "Nominal Taskbook" of the student on the topics of subject (definition of the optimal size of shaped timber, head equipment selection, the problem of two machines);

-methods (explanation, reasoning, dialogue, discussion, "model" exercises, didactic game, problem, heuristic, research, demonstration models, simulation);

-forms (lectures, seminars, workshops, round tables, scientific and practical conferences, online conferences, discussions, online tutorials, videos, etc.).

Since the success in forming of IPC depends on the nature of motivation, then the increase of the last is carried by us through spreading range of motives. The productive are forms of activity in which students take subject positions (heuristic discussion, scientific dialogues, work in special courses, scientific conferences, preparation of "Nominal Taskbook", Internet-conference).

Analysis of the changes taking place in the motivational sphere of the experimental group of students shows that in the first place in the ranking came cognitive motivation and desire to become a professional. Previously, they were respectively 6 and 7 positions, unformed motivation ("gone to study, so parents would", "should finish Institute") relegated to last place. In 2010 we noted the dynamics in the development of self-motive than in 2011 from 8.7% - to 17.8% - in 2012 and to 34.6% - in 2013 personal motives was the realization that students mastering information competency not only deepen their knowledge on a particular subject, but also to "work" for the next professionalism. Personal growth of the student in the process of forming organized us IPC observed in the analysis of reflective judgment of students, who are aware of the priority skills information modeling and solving skills system is a complex task. So, the students noted that simulating complex production problems, they are able to" work skills to interpret the text situation - production problem adequately mortgaged meaning and purpose", "work out the ability to use different language constructs images essentially opportunistic production problem in the making new "; "Go the way of learning solutions (creative) problem from the inception of a creative idea to its realization in a specific problem"; "Get a broader view about the nature of information processes, information modeling, which is then backed up by their own mental activities when creating a mathematical model, writing essays and research papers" Student saying: "For the protection of laboratory work, I first stated understanding of the problem, formulate the problem, and only then, presenting his model, built his response" shows both the reproductive operations and actions of the student "walked" to the municipality's own information modeling activities. Constant students appeal to create information models in solving situation-production tasks, requiring transition from intuitive to the logical design by the languages of coding, gives a positive result: students demonstrate the use of the system analysis, formalization, logical operations, allowing to roll background information, providing at the same the semantic value of the received empirical model of analytical. Students significantly expand their scientific understanding of the applicability of information modeling as a means of learning the essence of phenomena, not only in the complex production situations, and in all areas of vital activity.

Thus, the formation of information professional competency in the process of solving complicated tasks involves not just masteringby students of certain skills with ever-increasing in volume and increasingly complex in content of information flows, and the ability to use them to make sense of their own "all manifestations of being" to build a holistic learning process in the information environment.

Didactic potential of the complex situation- production tasks: belonging to the intellectual type of tasks (production line representation in general); Problematic (qualitative composition studied TP); focus on the subject (automation TP); Content - a description of the manufacturing process slabs materials; The presence in the structure of the object (object modeling, for example, pressing plates), requirements (target simulation, for example, force increaseofslab c), subject to the conditions for the implementation of the contradictions between the known things (press time, humidity, etc.) and unknown (strength and rigidity of the plates) - allows you to use it as a means of forming the IPC.Formation of students' information and professional competence is achieved in stages (development of reflective capacity, structural model of thinking, the ability to work with the information) in accordance with the decision of the system is a complex task and tasks of different types : reproductive, creative, heuristic, distressed ; sociological, psychological, mathematical, etc.

Complicated tasks complex system introduced six types of problems:

1) tasks, which are based on a problem that arises in connection with the evaluation method of choice of action - geometric modeling, process modeling and simulation gluing veneer mixing process ;

2) problems, which are based on a problem that occurs in the presence of facts containing real or apparent contradictions - placing objects on the production floor, the formation of the production program, the optimal consumption of raw materials;

3) tasks which are based on a problem that arises in connection with the various estimates of the same phenomenon - the placement of furniture in the space of the body, the production technology of laminated materials, plywood production, optimization of research equipment;

4) tasks which are based on the problem, assuming justification or refutation of some phenomena assessment - making internal or external layout products, wood machining, photochemical modeling curing polyester varnish;

5) tasks which are based on a problem that occurs when the material allows for the opportunity to make estimates opposite conclusions about the phenomenon - value analysis, optimization of compression plates, the problem of replacement equipment;

6) of the problem, which are based on a problem that occurs on a "cross curricular level" - design, strength calculation, optimization of timber size figure, hydrothermal treatment of wood.

tasks, formulate the problem, and only then, presenting his model, built his response" shows both the reproductive operations and actions of the student "walked" to the municipality's own information modeling activities. Consider the first type of situation-production tasks, which are based on a problem that arises in connection with the evaluation method of mode of action – geometric modeling, process modeling of mixing and modeling of gluing veneer.

Consider the model building process of mixing materials.

Laboratory research plan:

Topic: "Modeling of the process of preparation of paint"

Didactic purpose: to consolidate the theoretical knowledge and develop skills in practical calculations to determine the optimal values of the transient time constant T graphical method and the method of least squares.

Educational objective: To educate professional responsibility entrusted to a specialist in scope, accuracy and precision in performing the calculations.

Educational objective: To develop analytical and constructive thinking, the ability to present, discuss and defend their views, the desire to study the acquisition of knowledge and research competence.

Type of laboratory classes: Lesson anchoring study of complex application of information competence (performance of work in the information environment), professional competence (selection of resin, solvent and concentration limits of paint) and the control of knowledge and skills.

Training Methods: Individual work under the guidance of a teacher.

Laboratory research equipment: PC Pentium, electronic version of the laboratory work in MS Excel, test program, notebooks to laboratory work, stationery, notes, and educational literature.

After that we put before the students purpose of laboratory work. After downloading electronic materials, students begin the study of theoretical material. Readiness to perform laboratory work is checked using the test program, the student has collected enough points proceeds to the lab.

Feature of the testing program is that the student gets the answer instantly on the screen, ie correct answers marked signs of Compliance (smiles).

The purpose of this study is: to build an analytical model of the process and determine the optimal value of the constant transient time T graphical method and the method of least squares, as well as check on the adequacy of the model.

During execution of laboratory work the student must maintain a workbook in which it should reflect: title, its purpose, mission, how to conduct research necessary mathematical calculations, the simulation results, the conclusions of the work.

When constructing a model of the mixing process in order to understand how and on the basis of what considerations received a mathematical model of the process of preparation of paint, a student need knowledge "law of conservation of mass", "differential", "differential equations", abilities and skills in MS Excel environment etc.

To successfully complete this lab the student should possess theoretical material to the appropriate section. Before carrying out the laboratory work necessary to obtain access to its implementation by testing. Student receives the requisite number of points is not allowed to perform laboratory work. In proceeding with laboratory work students LKM.xls download the file. On Sheet "LKM" window opens with a brief description of the process of preparation of paint where the highlights are highlighted in different colors.

To conduct research to verify the adequacy of action, the following concepts: "differentiation", "least squares method", " the system of equations", "value" and "accuracy".

The next step - is a demonstration of work done by students. At this stage, the students displayed on the monitor results of the work done by comparing the values obtained ekspermentalnym constant time by graphical method and choose the optimal value, and make the appropriate conclusions about the adequacy of the resulting model. At the end of class the teacher assesses students' knowledge, depending on the performance and completeness of responses. Next, the teacher summarizes, gives an overall performance evaluation and issuing homework by asking prospects exploring new topics.

In mixer receives : the painting material at a flow rate G1, C1 at a concentration of solvent, the solvent at a flow rate G2, a solvent with a concentration C2.

Consumption of paint and solvent outlet G = G1 + G2, with a concentration of C. During dt delivery solvent into the mixer will be (G1 * C1 + G2 * C2) * dt, and its output during this time G * C * dt, the increment V * dC.

Assuming perfect mixing of the solvent into the mixer, i.e. that the solvent concentration is constant and equal to the volume concentration at the outlet, we can write the model preparation process coatings.

In order to formulate the optimization problem need to target functions - concentration versus time to put appropriate limits and select the optimality criterion.

For the process optimization problem reads required to determine the optimal time of transition T, in which the content of the solvent concentration is within acceptable limits and the mixing time will not exceed the specified interval.

In developing the content of classes, were taken into account: the complexity of the students' activities and the selection of the material as close to the conditions of practice work. Obligatory condition for good or even excellent object study is the ability to formalize the problem. In compiling meaningful verbal descriptions, all identified connections, features of functioning, characteristics, management and disturbances etc. are written. In formalized description primarily the theoretical foundations of the object functioning are identified, the equation of constraints and other informational items are made.

The next phase of the students' research is to test the adequacy of the received analytical model and verification of the accuracy. Modeling and optimization of TP points primarily on the specifics of the object, the uniqueness of its contribution to the process of finding the optimal TP regimes.

It is in terms of "analytical model", "empirical model", "value" and "processing of the experimental results" reflected the qualitative aspect purchased IPC. Formation of professional competence of information acts as a kind of total student development and achievement expresses completeness quality modeling and optimization, as well as the ability to simultaneously creative approach to design and research activities. Skill as a thought experiment to produce during the modeling process for new and better ways to build it can be designated as a research student competence [1, p. 24].

Manifestations of this property caused by technological range [2, p.15], in which the student is able to act professionally, as well as its ability to "transform" into a source of experience to improve research activities. Introducing the concept of a research student in the context of a range of IPC by the necessity of forming a clear idea of the boundaries and extent of the impact of its actions.

On the basis of this competence formation structure in the field of computer modeling by the students, the movement from the use of separate competencies in the field to the system perception and the formulation of optimization problems become possible. Ability to perceive systematically the surrounding reality helps in building of information models of the studied objects, in creating predictive algorithms for finding optimal solutions and enter the conceptual level of exploratory behavior.

The systems of automated design provide new technology and tools for using geometric models in the design process, and also require "information" potential of the engineer-technologist. In training students, the basic graphic training becomes very important.

It contributes to the development of such important qualities as creative thinking, intuition and professional flair. According to one of the leading mathematic P.Bezier that none of the computer-aided design could not be established and operated properly without the aid of mathematicians and technologists who have excellent knowledge of geometry [3].

The use of traditional means of graphics combined with computer technology allows to make the necessary spatial reorientations first mentally and then display the result of mental operations. Thus, such abilities keep up to date, as visual perception, productive imagination and spatial thinking of

students and others. Briefly description of spatial thinking can be defined as follows: "spatial thinking is a specific kind of mental activity that takes place in tasks solving, that require orientation in practical and theoretical space (both visible and imaginary). In its most advanced forms it is thinking in images in which the spatial properties and relationships are fixed.

We believe that in the process of students' design and research training, aimed at establishing of information - professional competency, the impact on logical and intuitive components of thinking assumes particularly importance.

IS Yakimanskaya [2] believes that, in terms of the original images created on the basis of different visual thinking provides their modification, transformation and the creation of new images, different from the original.

However, the development of students' abilities to design and research activities in the process of solving complex system SDRs have a significant impact, both positive and negative factors associated with the specific application of computer technology. For example, opportunities for students to "think" functions of the program, the algorithms use new means of expression design that complement those created by imagination, expand the range of training. But there is a danger that over time, the students produced a pattern of thinking. At the same time the opportunity to realize the plan may be limited to functions of the program. Especially if incorrectly selected for graphical application or provided insufficient knowledge necessary functions, commands and results of the actions of the software. Spectacular opportunity materiality of objects, special effects lighting, excessive enthusiasm modeling tools can also distract from the main idea and the real problems facing students in the design process. Also difficult to switch from targeting the external (from the image on the computer screen) on their mental operations ("internal" action). Attention in this case becomes outwardly directed and distracted from the analysis of the results of thinking. Compensate these adverse factors contribute to a well-organized training, the content of which holds exploration of various kinds of computer graphics, building the necessary tools possession at the professional level, the optimal choice of software, perform the preliminary work using traditional graphical tools, well-organized control by the teacher. Implementation of the principles of information activities personal technology solutions complex system is a complex task.

Effective means of information and formation of professional competence in the implementation of geometric and information model was developed didactic software including system situationally - production tasks, system guidelines and individual tasks, control and graphic works that are adequate to set goals and individual needs of students. Necessary to specify the direction of the research design and meet the following qualitative characteristics : the content and logic of educational material; focus on solving specific problems of training, the implementation of the integration of technical disciplines and interdisciplinary connections (optimal constructive solutions, rational choice of materials, ergonomics and problem solving, etc.). Tasks should assume the variability of results, to promote skills to design and research, build knowledge and skills to build different images using traditional and computer graphic tools, the ability to freely model objects of varying complexity rational ways. Ways to perform tasks should be varied, contain a certain novelty and be aimed at creating individual trajectories of educational and creative activities. Criterion for evaluation tasks should be formed on the basis of the students' personal experience, when compared with the best examples of works.

In formulating the conditions and graphic tasks should take into account :

- The area of practical application of new information technologies;
- The functionality and features of the software;
- The estimated degree of manifestation abilities in teaching and creative activity and the possibility of individual approach to its assessment;
- The character designs modeled objects (cabinet and upholstered furniture, machinery and equipment);
- The difficulty level way to create design of the proposed facility, features different purpose tools, commands, program operations, methods of computer simulation objects.

We have developed a system of tasks in computer graphics and the course "Fundamentals of computer simulation "includes several types. The first type is referred propaedeutic assignments for each topic studied. They are aimed at the acquisition of graphics knowledge and skills, learning the basic rules of implementation of project activities. Ie flat simulation. The second type is represented by the basic graphic elements with job creation. This type of job involves the creation of new facilities and the use of graphical knowledge and skills in their image as a drawing. Third - combines complex works on one of the topics studied. This type of job is focused on the development of the design and implementation of

several drawings of objects around a common theme. Assignments of the third type are not mandatory and are performed at the request of the students during the semester.

Task System on the subject "Fundamentals of computer simulation" consists of five types of jobs. The first type of tasks we have assigned the task exercises aimed at exploring the complex instruments, operations and algorithms, as well as the formation of automated skills to work with graphics software. The second type of graphic tasks we assigned to reproductive. It aims at modeling of objects from a given sample and the algorithm to obtain general information about the interaction of graphical tools and features of certain results due to consistent application of various software and operations teams.

The third type of jobs - propaedeutic characterized by simulating the shape of the object for a given sample with an independent choice of methods and sequence constructions or prompted modeling techniques. Propaedeutic tasks aimed at exploring rational methods of creating images using computer graphics.

The fourth type of tasks - basic tasks with elements of creativity - essential for the formation of experience of research activities for the development manifested in her abilities. To perform these tasks you need to choose an object, subject, methods and sequence of constructions with a possible clue search area, forming a rational sequence.

The fifth type of jobs - creative complex - directed solely on in-depth, professional mastery of traditional students and computer graphics tools in their optimal combination for the implementation of maximum creative expression, the manifestation of individuality and independence of students, on the manifestation and development of their abilities to design and research activities. Performance of tasks of this type involves the free choice of the means to solve the problem, the development and use of any plug-ins and applications, the study of which is carried out without control of the teacher.

Most effective in the development of learning technologies in higher education are such active learning, as a virtual design and analysis of complex situational-production tasks. Such work students complete courses in the study of " Modelling and optimization of technological processes" and "Fundamentals of computer-aided design".

In the virtual design reproduced the process of creating or improving conditional or simulated object -based computer technologies. Educational and cognitive research and student activities aimed primarily for the design and study of the object being studied. Such learning technologies are especially effective if they are implemented directly in the enterprise, where the process of implementing innovations, development and implementation of innovation that makes virtual design in modeling real-world objects and processes. This approach is of great importance for future cognitive specialists.

We believe that in the process of design and research training to students, aimed at establishing information and professional competence, particularly important impact on logical thinking and intuitive components: presentation of problems with incomplete or redundant data; focus on the desired quality criteria solutions, the transition subconsciously stored information in mind; increase the personal significance of the result of academic work ; emotional involvement in the search process; conscious shift of attention from the major components of a search on the perception of the problem situation as a whole.

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