будь-якого технічного вузу. А що тепер? Кожний заклад має свою програму дисципліни, хоча їхній зміст повинен бути стандартизованим, але цього ніхто не контролює. Наприклад, дисципліна «Нарисна геометрія, інженерна та комп'ютерна графіка» викладається у всіх технічних вузах. Так у провідному вузі КПІ на неї відведено 360 годин, у нашому на деяких спеціальностях – немає жодної години. Хоча кафедрою основ конструювання механізмів і машин виданий підручник з грифом МОН України «Інженерна та комп'ютерна графіка». Зміст цієї дисципліни викладають такі кафедри, яких немає в жодному вузі.

Навіть програма одного напряму «Гірництво» з інженерної графіки на гірничому і шахтобудівному факультетах відрізняються за своїм змістом.

Складовою підвищення якості підготовки фахівців – є інформаційно-методичне забезпечення навчального процесу. Відомо, що на деяких кафедрах цим питанням займаються тільки в силу необхідності акредитувати спеціальність.

Викладачі деяких випускаючих кафедр вважають, що вони краще знають математику, інженерну графіку та ін. предмети, ніж кафедри, за якими закріплені ці дисципліни наказом ректора й викладають їх. Мало того, пишуть інформаційно-методичні матеріали з цих дисциплін, з цих дисциплін, при цьому намагаються ще й отримати гриф МОН України.

Кілька слів про інформаційно-методичне забезпечення навчального процесу. Так деякі рукописи, які надходять на розгляд редакційної ради НГУ, дуже «сирі». Хоча наказом ректора ДВНЗ «НГУ» № 351 від 01.11.2011 року пропонується завідувачам кафедр і деканам факультетів розробити заходи щодо підвищення вимог до якості рукописів навчально-методичної літератури, при цьому: «У заходах передбачити підвищення ролі та відповідальності кафедр, методичних комісій з напрямів підготовки і спеціальностей у справі забезпечення якості рекомендованих до видання рукописів навчальної літератури, обумовити порядок попереднього розгляду їх змісту, доцільності видання, визначення тиражу, підбору рецензентів та оцінювання якості рецензій». Нажаль деякі методичні комісії з напрямів підготовки і спеціальностей формально відносяться до цього питання.

UDC 377

## INTEGRATION OF TECHNICAL KNOWLEDGE AS A WAY OF FORMING OF PROFESSIONAL COMPETENCE OF STUDENTS OF TECHNICAL UNIVERSITY

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**Abstract. .** The article describes ways and methods of improving the quality of graduation in Oil and Gas Engineering by means of implementation of the competence building approach within the modernization of the content of professional education. The article proves the expediency of use of the activity approach in formation of professional competence of students of technical University and the experience of implementing this approach. The author emphasizes the importance of the discipline of mathematics in its function as the basis of professional education and pays special attention to the determination of the types of competences and the formation of general professional skills of bachelors. The article deals with the basic concepts of the «task» and the author's understanding of the term «task». The author presented the experience of the development of practice - oriented tasks for students of technical University. The article also considers the experience of implementation of this technology at studying mathematics at the Petroleum Technological University in compliance with the requirements of the third generation standards. The technology of professional competences formation is offered. Special attention is paid to the technology of formation of professional competence of students of technical University. In this article, stages of organization of the study process at implementation of the technology of the problem-based approach in the education are provided. Specific examples are considered methods of organizing the formation of professional competences.

The author reveals the subject matter of a mathematical problem in its function as the basic means of competence formation with the students of technical higher education institutions shows the relevance of treatment in learning process task approach and suggests specific methodology for forming key competences through solving technological problems.

*Keywords: professional competence, basic concepts of professional training of future engineers, a problem in its function as the means of forming professional competences.*

**Introduce**. The process of forming mathematical competence with the future engineers determines the teaching them in technical performance, which is related to the ability to solve real production problems.

The “problem” concept is one of the fundamental concepts in mathematics. Currently, there are various approaches to the interpretation of this concept.

In its very general meaning, a problem can be interpreted as a goal, which requires to be achieved, and as an issue, which requires to be solved based on definite knowledge.

The analysis of various interpretations and definitions of the “problem” definition makes it obvious that it is mainly determined by the essence of relations between the subject and problem concepts.

The followers of interpretation of a problem as the situation, in which the subject must act, explicitly include it in the problem concept. Y.M. Kolyagin

and G. I. Sarantsev noticed in their works that, without the subject, there is no problem, and that a stipulated condition is a problem for some people, and can be not a problem for others [1].

L.M. Friedman determined a problem as the model of a problematic situation expressed using the characters of a certain artificial and natural language and believed a problematic situation be the source.

And A.M. Leontyev, in his works, dealt with the problem, all elements of which were mathematical objects that were solved using the mathematical apparatus [3].

To summarize the above, we can conclude that the vision of problems depends on the sphere of knowledge, which they belong to. Using this term, we need to specify what subject matter is assigned to the "problem" concept.

The main attribute of a problem is the temporal absence of methods of its solution, i.e. absence of any logical sequence of definite procedures in the educatee's consciousness, which procedures would associate the statement of the problem with its requirements [4].

S.F. Dorofeev treated a problem as a certain situation of the subject-object category, which needed to be solved with account of the conditions specified in it.

We keep to the opinion of Y.M. Kolyagin, G.I. Sarantsev, L.M. Friedman, and S.N. Dorofeev and understand a problem to be the activity of a subject in its function as a system of problem solution processes, which consists of not only the standard, but also the creative elements of activity, which are not only introduced from outside, but also related to the motivation of its personality.

Based on the above, we believe that it is possible to form professional competence by solving the problems, which are the synthesis of objective and professional conditions.

We have contributed to the discussion on implementation of the principles of competence building approach at teaching bachelors in engineering sciences.

The obvious problems in the implementation of the main education programs for bachelors, i.e. the process of teaching in the language of competences, currently are:

- absence of methodological tooling, which would allow forming and evaluating the competences of graduates; development and implementation of the system of objective diagnostic educational procedures.

The objective of the research is to suggest a solution of the problem, which resides in the formation and evaluation of the extent of acquired competences after passing the main educational program for bachelors in Oil and Gas Engineering, code 131000. The research was carried out through the example

of assimilation of the program of the mathematics discipline. Then, the conceptual models of the process of formation and evaluation of the most important cultural and professional competences of the CC-1, PC-1, PC-2, PC-4, and PC-6 types (refer to the Federal State Educational Standard of Higher Professional Education "The Main Education Bachelor Degree Program, Code 131000").

In our opinion, the technology of teaching students to solve mathematical models of professional problems must provide stage-by-stage education, namely according to the following procedure:

**at the first stage,** algorithmic problems must be dealt with;

**at the second stage,** it is necessary to consider the problems on the heuristic level, which target formation of the knowledge how to deal with technological issues;

**at the third stage,** it is necessary to use problems oriented to formation of the ability to solve generalized applied practical issues.

The problem-based approach in the implementation of the competence building approach is in harmony with the synergistic approach. Synergetics, as noticed by V. Milushev, evidences that the path to the future for complex systems, which show non-linear development, such as the future professional activity, always has alternatives [6]. Thus, arrangement of education in the context of synergistic approach brings us to formation of the ability of self-teaching of the "How-to" type. The extent of the cognitive independence of an educatee and his ability to apply the fundamental knowledge in his professional activity depend on whether the following *skills* have been formed with him:

1) to see the issue in a problem and understand it;
2) to formulate methods of solving the problem;
3) to reason the methods of solving this problem;
4) to apply the determined method of solution in practice.

Such skills can be mastered in the course of studying mathematics based on the methodological system, which is oriented to forming profession-oriented skills. The mathematical model we have built conforms to the basic principles of synergetics, as along with the free self-development, self-organization, and viability properties, it needs the properties of imbalance, instability, non-linearity, etc.

Solution of profession-oriented problems leads a student to the bifurcation point, gives an impetus to search for the exit from the previous stable knowledge to the new one - and it is the path of self-development.

In our opinion, it is the problem-based approach to the study of mathematics that encourages the development of the synergistic effect with the students, which depends on their aspiration to improve their knowledge with account of their own capabilities and faculties.

Synergetics provides the opportunity to re-formulate questions and re-construct problems, which ensures better quality of the students' training.

Let us consider the technology of forming professional competence PC-1, which involves "self-directed acquisition of new knowledge using advanced educational and information technologies".

Process structure: solution of the technological problem; e.g. after the study of theoretical material on the theory of probability [7], the problems of the following type are offered for solution: "In an oil-bearing area, six oil wells are being drilled simultaneously. Each well independently from the others opens up deposits with a probability of 0.1. What is the probability of opening up a deposit? How many oil wells need to be drilled, so that the probability of opening up an oil deposit would exceed: a) 0.7; b) 0.8; c) 0.5; d) 0.9?"

Teaching technique:

Main stages of the arrangement of teaching the scenario of the simulation exercise "Conditional probability. Probability of at least one event of the total group of events":

Stage I. Assessment and reinforcement of the level of knowledge of the educates in the issues relating to the matter of this subject.

Stage II. Selection of formulas and methods of solution. Group discussion of the problem solution. (Division of the participants into small creative groups (3-5 persons); each group solves its own variant).

Stage III. Solution of the problem in small groups, preparation of reports on the discussion of the problem solution. Monitoring of the work of each participant with grading the individual work and explaining these marks.

Stage IV. Solution of the subproblem: to assess the influence of one of criteria of the probability of opening up a deposit. Discussion of the results and scoring them.

Stage V. Summary of the game results, analysis of mistakes, reasons for assigning the bonus and demerit scores. Discussion of the assigned final grades.

Statement of such problems provides the opportunity to find the methods of their specific solution based on the existing theoretical knowledge and to form competences.

Another method of forming the professional competence PC-4 ("to master the main methods, ways, and means of obtaining, storing, and processing information; to operate a PC as a means of handling information") is the fulfillment of laboratory works in the form of technological tasks [7,8], usage of a package of PC software for fulfilling computational experiments and analyzing their results, for example: "Based on the geological data of the Bavly deposit, it is necessary to provide calculation of the oil reserves and the change of the average rock pressure within the oil reservoir."

Teaching technique:

Stage I: to study the results of geological survey and determine the methods of calculation;

Stage II: to solve the assigned problem using the MathCAD suite.

Stage III: to provide the analysis of the received results and prepare reports of small groups.

The methodological value of solving such problems resides in the fact that students acquire not only the steady mathematical knowledge, but also the skill to apply the methods of problem solution in practice.

Thus, as evidenced by our experience and the analysis of professional literature, in order to form professional competence with the students of technical higher education institution by means of the mathematics discipline, it is necessary to use the problem-based approach more extensively, as it allows to form the ability to solve professional problems using mathematical modeling, the skills to relate the mathematical knowledge to the subject matter of the special disciplines.

**Summary.**

1. The methodology of forming and evaluating the level of knowledge, skills, and acquired cultural and professional competences of the graduates of the bachelors program in technical specialties was developed.

2. The following principles form the basis of the methodology:

- maximal approximation of the object of the training and scientific research to the future professional activity, with the help of technical problems;
- comprehensive application of methods of mathematical modeling and fulfillment of computational experiments using renowned mathematical software suites;
- organization and execution of interactive forms of the study process, with the emphasis to and support of the processes of self-analysis and self-diagnostics.

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## АПОСТЕРІОРНЕ ОЦІНЮВАННЯ ОРГАНІЗАЦІЇ НАВЧАЛЬНО-ПІЗНАВАЛЬНОГО ПРОЦЕСУ

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**Анотація.** У статті розглядується питання застосування технології *апостеріорного* оцінювання навчально-пізнавальної діяльності студентів. Результати апостеріорного оцінювання надають важливу інформацію про ефективність викладання викладачеві та навчальному закладу.

*Ключові слова: якість освіти, апостеріорне оцінювання, навчально-пізнавальний процес, технологія апостеріорного оцінювання, показники оцінювання.*

## АПОСТЕРИОРНОЕ ОЦЕНИВАНИЕ ОРГАНИЗАЦИИ УЧЕБНО-ПОЗНАВАТЕЛЬНОГО ПРОЦЕССА

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**Аннотация.** В статье рассматривается вопрос использования технологии *апостериорного* оценивания учебно-познавательной деятельности студентов. Результаты апостериорного оценивания предоставляют важную информацию об эффективности преподавания преподавателю и учебному заведению.

*Ключевые слова: качество образования, апостериорное оценивание, учебно-познавательный процесс, технология апостериорного оценивания, показатели оценивания.*