

USE OF INNOVATIVE TECHNOLOGIES IN EDUCATION OF HIGHER MATHEMATICS FOR STUDENTS OF INSTITUTION OF HIGHER EDUCATION

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The article looks into the use of innovative technologies in a process of Higher Mathematics education of students of technical universities, instances the setting up of gaming control tasks for testing of theoretical and practical knowledge, skills of their utilization in solving of practical tasks.

Preparation of students for future professional activities must not only arm them with theoretical knowledge, but also aims to provide intellectual development of their personality, flexibility of thinking, encourage the desire for self education, raise the professional orientation: i.e. to form the components of professional competence of graduates.

The use of innovative methods of education allows solving the tasks of boosting the theoretical and practical training of students; developing of skills of self education, creating and strengthening the knowledge of specific profession, advance such characters as entrepreneurship, creativity, anxiety, aspiration. At such classes the competency of students develops, shapes the abilities to think fast, analyze, take responsibility, and besides the control of knowledge, happens its generalisation and deepening.

Pace of life today changes and complicates the process of education in technical universities. Students have to work hard and actively to assimilate the necessary professional knowledge. Student activities aimed not only at mastering some of the content of social experience, recorded in a form of academic data, but also for formation and development of professional abilities and personal qualities.

Now it is not enough for the teacher to be competent within his specialty and transmit his knowledge to the anxious student audience. Current teachers should be prepared to not only share a deep knowledge of their discipline, but know little about the students and how they learn. Besides, teachers have to use different methods of teaching and assessment, which they may actually have not used, or their use was limited. Innovative technology of education is not always perceived by all teachers, but these studies can not be ignored, confirming that their use is the most effective way to help students.

Obligatory condition for conducting of practical classes, laboratory works, which according to the innovative techniques aim to consolidate the acquired theoretical knowledge, is that there should be a previous study of theoretical material, students mastering of basic concepts and terms. There must also be organizational and methodological work not only by a teacher (a type of final rehearsal), but also by students. And as the latter will be actively involved in the preparation of such studies, the more successfully they will be held.

In order to intensify training of students, there should be performed the use of whole arsenal of methods of organization and implementation - verbal, visual and practical, reproductive and search methods, inductive and deductive, as well as methods of unrestricted work.

Each of the methods of teaching and learning activity is not only informative, but also motivating. In this context one can talk about stimulating motivational functions of any method of education. Based on experience of teachers, scientific studies etc, there are a great number of techniques specifically aimed at forming positive motivation of education, which stimulate cognitive activity and simultaneously contribute to the enrichment of students' academic information. Stimulating function in this case becomes a priority and promotes the fulfilment of educational task of all other methods.

The main source of interest for the education is primarily its content. In order to accomplish the content to be quite a strong stimulus, it must meet a wide range of requirements set out in the principles of learning (scientific, connected to life, systematic, successive etc.). To intrigue the students teachers use some special techniques. These primarily include such techniques as creating a situation of novelty, of relevance, of adjusting content to the most important achievement in science, technology, modern culture, art, literature. To this end, teachers choose specific events, pick up the facts, illustrations, which currently are the most interesting.

Feature of education is to build knowledge, form skills of study and learning in the students. We support the conclusion of scientists [1] that in the process of selection and consistency of study methods there should be used following criteria:

1. Compliance with the principles of education.
2. Matching the purpose and objectives of education.
3. Matching content of the topic.
4. Conformity to educational abilities of students: age (physical, mental), level of knowledge (education, breeding and development), peculiarities of class.
5. Conformity to existing conditions and allotted time for training.
6. Conformity to capabilities of the teachers (experience, theoretical and practical readiness, personal qualities, etc.).

Consider one of the methods of stimulating learning activities of students in learning higher mathematics.

We have to mark the domination of gaming over other methods of innovative education, that provide primarily the opportunity to create such quality that the other methods at a short time are unable to cultivate, such as: communication skills, professional ethics, the ability to analyze and take correct, firm decisions. Moreover, these methods improve the discipline of students during lessons; accustom students for self study with the academic and scientific literature, creating favourable conditions for the formation of creative personality. Participants of gaming lessons in the process of simulation get more specific understanding of the nature of their future professional activities.

In order to use gaming techniques, especially business games, in the learning process a fundamental importance is a comprehensive approach. It requires the teacher to concentrate all efforts on the formation and development of students' positive attitude to learning, humane relationships between students.

Naturally, each method together with positive have negative moments. The main disadvantages of the classes-competitions, gaming forms, include the fact that in the game the student can't work on individual issues as long as it is necessary for him, he is forced to obey the rhythm of class, in a game student agitated, he often goes to the peak activity and sometimes unable to think calmly.

Mathematics provides opportunities for detection of free creative personality. But interest towards the subject arises when the student understands what the teacher awns, when the problems are interesting for him, when students himself need to think, draw conclusions, generalize, when he sees the prospect of using knowledge in practice.

Lets find under what conditions it is advisable to use the gaming forms of classes during the study of higher mathematics.

Firstly, the subject of higher mathematics is a sufficiently linked system of definitions, theorems, rules. Logical sequence of it, is that each new definition, a rule, theorem is based on the previous theorems, previously introduced, argued and proofed. Each new task includes elements of problems, previously considered, described etc. These connections among chapters of mathematics, their interdependence, incompatibility with gaps and omissions, the inadmissibility in whole and in its parts, generates a feature of mathematics that is often a reason for unsuccessful study by students, consequently, the cause of lost interest in it. The subject of mathematics - is not only linked, logically stable information system – it is a system of mental tasks, each of which requires justifications, arguments, i.e. logical effort. Every task, issue in mathematics – is a problem, solving which requires the effort of thought, perseverance, will and other qualities of the individual.

These features of mathematics create favourable conditions for the emergence of thinking, but at the same time, they are often the main cause of passivity. Last, may occur especially in those students who were not accustomed to systematic self study. However, the use of gaming sessions in this case is not disinterested.

Second, students have a different motivation. Sometimes they can focus on the heavy and monotonous work to reach a distant goal, but it is unlikely to be developed in them at that age. Therefore the need of studying and understanding mathematics, importance for the practical use of it, is not a sufficient condition for its active study. Short-term motives sometimes absent, motive of practical significance is weak, and then the motives at the moment do not have their "life meaning." Presence of only distant motives, which are supported by words, do not create adequate conditions for the detection of persistence and activity. This can be observed during the solving of problems of increased complexity. These work students consider useful for the development of logical thinking. But the difficulties they encountered, are so large that emotional recovery, which was in the early solution, disappears, which leads to a weakening of attention and ultimately to passivity. In these situations with great effect can be game situations that contain elements of competition.

The third, often after a long mental work even an easy material does not cause activity. Introduction of game elements during class can help break the intellectual passivity of students. It is in the creative work ensured the implementation of a central individual need: a need for self-expression.

Here's an example. Vector algebra is part of the course of higher mathematics in the technical universities, which study in first semester. It is of great use in studying

physics, special classes etc. At lectures it is desirable for presentation of theoretical material to use the problems with physical meaning, moreover, a lecture of finding the formulas of scalar and vector products may be created, not starting with definitions, but with physical problems. For example, before defining of scalar product during the lecture there may be formulated the task: Coordinates of force F acting at item $(3H, 4H)$. Coordinates of movement of the point $S(7m, 1m)$, we should calculate the work of force F and angle between force F and displacement S .

At the workshops we offer after acquiring the skills to solve common problems of vector algebra classes hold a game to use physical problems. This may be planned on the last practical classes on vector algebra. Since the academic group is more or less adapted, and the teacher has the imagination of the ability of students, a distribution of roles may be performed by himself. For students of various faculties imitation situations are developed according to future career.

For example, for students of the faculty of construction, we offer the following: the design bureau has to comply with the order of construction of which consists of a complex of interrelated calculations. Academic group of students is divided into two groups, appointed chief architect, expert council (2 students), and leading designers in each group.

Objective of studies: educational – to check the actual level of learning of material and basic principles, to form abilities to use theoretical knowledge and skills in solving problems of practical content; developing – to develop skills of self-organization of work, professional orientation, educational - to promote the formation of such qualities of person, as communication, ability to manage and obey, determination, responsibility.

A team receives a complex task that they solve together under the guidance of leading designers. Assignments are designed to use several formulas related to vector algebra. Each group solves problem together, if you are having problems in solving, the leading designers may ask for help from the chief architect, but in that case receive penalty points. If the chief architect has no answer, he consults with the Council of Experts, that is also a case for penalty points to him.

The teacher can take part in the game doing the role of a member of the expert council, if not participate, he must provide the expert council with solutions to the problems, or offer to pre-solve them in advance, and before the class test solutions and evaluate them.

To test the acquired knowledge and skills we developed the semester gaming control test.

We consider to propose a game situation: a production company is ready to be established in order to produce a new generation of computers. It consists of two units, the teacher assigns the director and the two leading managers. They must choose a 10 vacancies out of 20 representatives of the group. To take these 10 people, tasks are set for the group, under found solution to which the director and senior managers will decide on the personnel to be hired. During the first semester were studied 7 chapters of higher mathematics:

1. Linear algebra;
2. Vector algebra;
3. Analytic Geometry;
4. Introduction to mathematical analysis;

5. Differential calculus of functions of one variable;
6. Integral calculus of functions of one variable;
7. The functions of several variables.

Tasks are one from each chapter. A group of 5 students receive 5 tasks, students decide for which chapter he is responsible in the group. An arbitrage is being formed, which may apply penalties. Penalties imposed on the director and senior managers for bias, for the errors during assessment of proposed solution – 15 point, i.e. the group performed the task, a leading manager approved it, but there are errors. However, there is a bonus for time. The group, which first performed the task, receives an additional 21 points, second - 11 points, third - 0 points and fourth with 10 points as penalty. Each subgroup receives an envelope with red slips – 10 points and green slips – 20 points, in total 70 points. These envelopes allow receiving additional information. If a student can not solve the problem, he turns to colleague and gives him some points for his advice. If the colleague has no solution of the problem, the student appeals to the lead manager. If the manager is unable to provide advice, he takes his 10 points and proposes to the chief executive. The last point of advice – is the teacher.

Each leading manager has two groups of 5 persons. The task of each subgroup is received in envelopes. There are you have two options to solve the task. The first option: the manager puts all task in one pool, and the subgroup solves the task together, after which the manager allocates points to each member of the subgroup. But through choosing of this option, subgroup spends much time. The second option provides that the manager himself distributes the tasks among the members of the subgroup and everyone solves assigned problem.

After completion of the tasks, manager puts all received answers to the envelope and reports to the director (chief manager) of the work performed. Director verifies the correctness of answers distributes points to leading managers and sends the workings to arbitration. Teacher and arbitration test the workings (answers) and mark the work of director.

As a result of this lessons on the one hand, attention, creative thinking, substantiation of assertions are being taught, on the other – it develops thinking, memory, capacity for analysis. Along with this, it teaches the students a teamwork, psychologically prepares to practice, develops organizational skills. In these classes students are interconnected and interdependent. This contributes to the creation of such relations, which organize labour cooperation, inspiring participants to jointly solve issues.

During these sessions, since the subject of higher mathematics is very seriously, we try to, as the famous mathematician B. Pascal said, "... not to lose the possibility to make it a little entertaining". Moreover, these classes allow students to repeat the material learned before the session (finals) and for teacher to check residual knowledge from previous topics.

According to our research, the use of gaming forms of education at workshops on higher mathematics improves the process of learning, enhances the skills of application of theoretical material to the solution of practical problems.

Training of engineers who are able to examine any physical or technical process requires identification of its objective laws, obtaining of analytical expression of functional dependence among parameters through use of theoretical knowledge, skills

and practical know-how. Combining traditional methods of education and gaming techniques partially solves the problem of quality of training of future professionals.

Exploring the problem of the formation of future professional competencies of university graduates during the study of mathematical disciplines, we are convinced that the use of gaming methods of education provides planned results when students play their specific roles; game-simulation situation creates an atmosphere of reality, the content is based on a specific practical context, which reflects the professional activity, providing a combination of study and professional development of future professionals. Specific roles oblige students to analyze and make professionally significant decisions, which increase the level of their professional competence [2].

Use of innovative technology in the teaching of mathematics at the Technical University is effective in the process of professional orientation of students, because we treat it as pedagogically organized, educational, scientific, professionally productive activity, which ensures the formation of their social and professional experience [3-7].

Insufficient developing effect of traditional education on the individuality of participants of learning process led the introduction of innovative educational technologies that have the features: forced activity - students are forced to be active regardless of their desires, student activity coincides with the active lecturer, independent creative decision making, high degree of motivation and emotionality; permanent "direct and follow up contact" between the student and teacher; professional orientation, development of professional skills and ethical behaviour.

Thus, there are more than enough evidence that the use of innovative technologies is an effective tool in teaching various subjects of fundamental cycle in the technical universities, especially higher mathematics, which are difficult to ignore. At the same time the problems that discourage teachers from considering of these technologies are surmountable. For the teacher, with his desire to make education interesting and productive, there is always opportunity to find such methods of training that he can use. These methods of teaching the higher mathematics can serve as an example for colloquia, lectures and practical classes at any other fundamental discipline in the technical university.

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