

CHARACTERIZATION OF THE NEW CREATIVE TEACHING MODEL

CHARAKTERISTIKA NOVÉHO MODELU TVORIVÉHO VYUČOVANIA

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Abstract

This paper presents a new creative teaching model, that could be used in the teaching process of mathematics and technical courses in the basic study at the technical universities. Model has been proposed as the result of the analysis of the most frequently used and the most successful methods for the process of problem solution and development of the creative thinking.

V príspevku je opísaný model tvorivého vyučovania, ktorý môže byť použitý vo vyučovaní matematických a technických predmetov základného štúdia na technických univerzitách. Bol navrhnutý na základe výsledkov analýzy najpoužívanejších a najúspešnejších metód pre proces tvorivého riešenia problémov a rozvoj tvorivého myslenia. V príspevku sú uvedené všeobecné zásady modelu a ilustrácia navrhnutého postupu na príklade vyučovania predmetu Počítačová geometria v 1. ročníku štúdia na MtF STU v Trnave.

Key words

education, creative teaching, creativity, creative thinks, technical courses, mathematics, divergention

vzdelávanie, vyučovanie tvorivé, tvorivosť, myslenie tvorivé, predmety technické, matematika, divergencia

Introduction

From an analysis of methods of problem solving and development of creative thinking [4] follows requirement to propose a teaching model for mathematics and technical courses of basic study at the technical university as a system of selected and modified methods for

development of creative thinking arranged in sequence. Methodological starting points in creating the model result from theoretical knowledge about creativity and creative process, from the characteristics of main signs of creative tasks and from analysis for methods of developing creativity. The teaching model contains techniques, which concentrate on development of students' creativity (exercises for development of fantasy, fluency, flexibility, elaboration, divergent tasks) as well as proposals of methods and teaching style, that should be used by teacher.

The Teaching Model

Aim of the courses of basic studies is not only to learn special terms, but also to contribute to education of a graduate an engineer, who is able to think independently, critically and creatively and to work in team. It is difficult to achieve this aim by traditional teaching, that is characterized by transmission - passing ready information to whole group, while students are passive receivers using mainly their memory. To achieve set aims needs didactically effective pedagogical influence, which can be achieved by the proposed teaching model, elaborated into 12 teaching units of 100 minutes each. Each teaching unit has three parts:

1. Relaxing - warming up part. The aim of this part is to eliminate barriers to creativity, and to introduce a creative atmosphere through simple relaxing tasks oriented on development of fluency, flexibility, originality, sensitivity and elaboration.
2. Solving of creative tasks - their content is in accordance with the teaching topic of specific exercises. In their creation were respected and used findings from the theory of creative tasks.
3. Assessment - every student had a possibility of confrontation of his/her own results with results of other students.

The first part of the model has also a motivation role. The aim is to activate an internal motivation, that is expressed by interest in activity itself and brings to a student pleasure and internal satisfaction. It is obvious that learning on the basis of internal motivation is more effective. Internal motivation originally initiated by an interest in subject can easily change into an external motivation - a need to be successful.

It is appropriate to use the form of group teaching with the stress on an individual approach, that is most obvious in the second part of teaching unit, since it is more difficult in the mass teaching. The tasks should be distributed in the beginning, so that every group could progress independently, on a working pace reflecting individual abilities of group members. Task of the teacher is:

- to compose appropriate divergent tasks, that would activate and internally motivate students.
- to follow work of students
- to provide consultations to students if necessary, and thus to initiate searching and creating of big variety and originality of possible solutions
- to evaluate the work of students

Students are encouraged in solving problems to use heuristic procedure, elaborated on the basis the Osborn 9 heuristic principles, inspiring questions of Pearson and Polya's questions for analysis of specific phases of the problem solving. Following are basic ideas:

- To understand a problem well. What is given? What is necessary to do? What are conditions? To propose! Those are basic presumptions and starting points for a successful solution process.
- To search a solution and to produce a variety of ideas: Did I encounter a similar problem? Can I use the method of its solving or the result? Can I solve a simplified problem? (object to reverse, to divide, turn, to move, extend, to combine)
- To chose best ideas - based on critical and fundamental analysis. Are all required conditions fulfilled? Were the steps used correct?
- To test on computer if solution is correct - advantages are obvious. A big number of possible solution can be checked and also possible solutions can be improved directly in dialog with the computer.

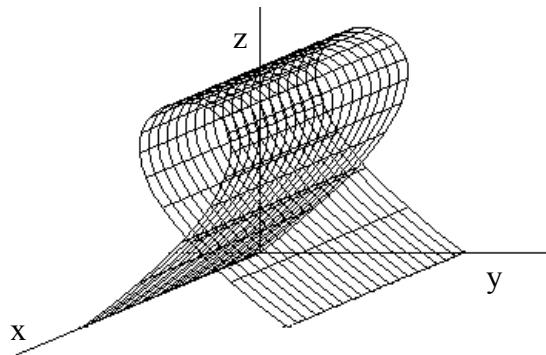
Outlined procedure has two phases - heuristic and critical. The most important task from the point of view of developing of creative thinking was to train heuristic phase and to have in mind emotional involvement into solution process. Time schedule of the model reflects objectives of courses. The first part takes maximum 10 minutes. This part should help to overcome barriers of creativity. The aim of its time restriction is to provide enough time for specific task solution. The substance of the teaching unit are part 2 and 3. A modified *research method* (computer support, inspiring questions, component of heuristic program TRIZ), one of five general didactic methods which are distinguished by Lerner [2] according to character of the students activity and its management by teacher was used in the second part of the teaching unit. Activity of a student is similar to research work of a scientist by its character and stages. This method is in teaching process specified by the method of solving of divergent tasks. Problem situation is introduced by an appropriate task, while it must be taken into the consideration that too easy or too difficult task does not create a problem situation. Focus of the teaching unit is at supporting students to independent study and to independent work. Students therefore solve tasks independently in groups of 2-3 members, while non specific transfer is also required (i.e. discovering of not known knowledge or application of knowledge in different conditions from conditions in which they were acquired) Since the key roll in problem solving has the process of creating ideas, some exercises can involve also the modified method of brainstorming - brainwritting, while written proposals are submitted by the group of two - three members together. The method has been used for stimulating of creative thinking, since separating of searching for solutions from their evaluation enables to overcome social and psychic barriers of creativity. A precondition for a success is familiarize students with the rules of the method and creating a relaxed atmosphere, where proposals of some students would have an encouraging influence on thinking of other students. Finding an optimal solution is not the most important in using this method in teaching process, but to develop creative abilities of students, to develop an ability of separating the phase of production of solution from the evaluation phases. At the same time, it is an opportunity to encourage future engineers to team work. In this teaching model the focus is on independence and activity of students, their internal motivation and development of evaluation and creative thinking. In order to specify a educational efficiency of the proposed teaching model, it was applied in course " Computer Geometry ", while keeping a valid teaching content.

Illustration of the propose procedure on the example the course Computer Geometry

Course CG is taught in the 1. year of the study MtF STU in Trnava. Content of the course is computer geometry dealing with geometric problems of the computer graphics and their solution by using geometric apparatus, such as: transformation, modeling of curves and surface, filling domain and visibility. The course is a result of modernization of the classical course descriptive geometry. Graduates often come across in practice graphical systems for computer support of constructing, planing preparation and management of the production . It is useful, therefore, for them to know geometrical basic of computer graphics. Not even work with graphical system can not do without elements with creative work, that is necessary in various adaptation, application and combination.

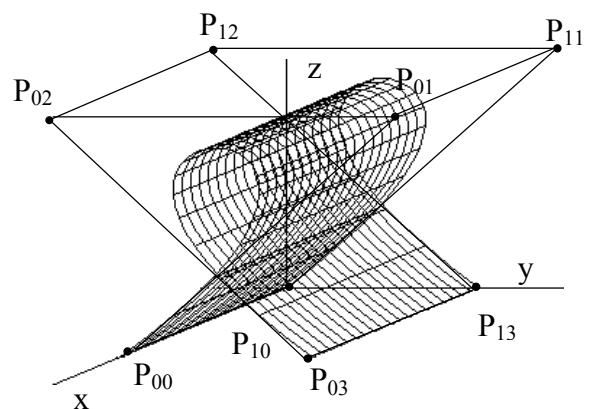
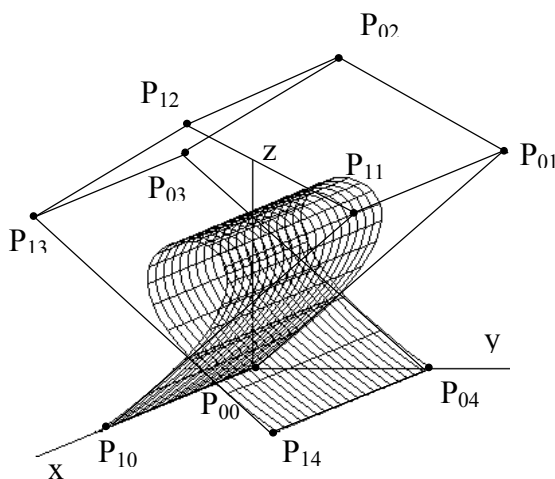
Proposal of the system of divergent tasks from the course is also part of the model of the creative teaching. This types of tasks is illustrated by the divergent task from the topic modeling of curves and surfaces.

Divergent task: Propose various as many way as possible for modeling surface on the picture.

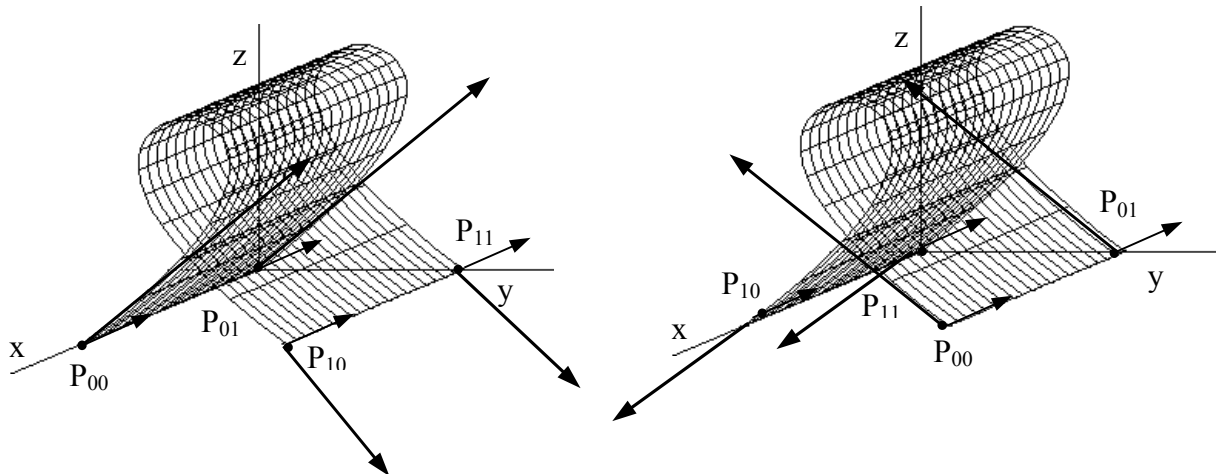


Exemple of solution:

Bezier's surface



Fergusson's surface



Example of solution of the tasks created by a program for modeling of surface. This program of authors Medek- Zámožík [3] is regularly used by students during course.

Conclusions

Educational efficiency of the teaching model outlined above, has been verified through educational research. Teaching model with utilization of methods supporting development of creative technical thinking was applied within condition of usual teaching. Actual curriculum was not changed. Results of research proved educational efficiency of proposed model. It revealed that divergent tasks developing creativity can be designed in each partial course. Research proved the contribution of solving these type tasks. They release barriers of creativity, have high motivations influence, improve student's attitude towards course, improve knowledge and designing of creative tasks improves creativity of teachers. Research proved, that creativity is possible to develop not only in special environs, but in condition of usual teaching without special requirements for change of curriculum and using the form of group teaching basically of differentiated approach and graduated requirements towards students. Teaching according to proposed model was more stimulating, attractive and all at once effective.

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