PROBLEMS
OF EDUCATION
IN THE 21st CENTURY
Volume 46, 2012

THE DEVELOPMENT AND MEASUREMENT OF THE EFFICIENCY OF MODERN DIDACTICAL MODELS IN THE TECHNICAL EDUCATION

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Abstract

Presented research shown a sensible inclusion of intelligent didactical environments in the practical work in the education of the technical field in Primary School. The teacher with his modest repertoire of hours dedicated to technical education confronts great challenges, like how to inspire the students for the subject with the introduction of many different interesting themes. Firm example of study lesson is based on theoretical foundations of Didactical learning theory, advanced version also named The Berlin model. During the process of teaching we transform knowledge into practical work and through a concrete example, designed a new modern didactical model. In this model the competences of a lifelong learning are included: methods for encouraging the motivation, use of ICT and developing informational literacy, encouragement of flexibility and persistence at confrontation with new challenges and exercises, ability to self evaluation, developing of communication and social skills. The results of experimental group, which execute activities in form of new didactical model in comparison with control group shown, that students of experimental group had less faults at making the model and they also spend less time to finish it. Consequential students of experimental group were much more satisfied with their product, they gained knowledge and they were also motivated for further work.

Key words: *Berlin model, educational model, lesson factors, lifetime learning, skills.*

Introduction

Different areas of education are distinguished by their specifications and they should be considered at lessons. Education of technical courses demands a lot of practical qualification, which enables achieving of practical experiences and knowledge. With current methods of work the results are not as expected. Higher cognitive goals, permanent knowledge and motivation are expected to be gained at teaching, with the use of modern methods. Today's students demand changes and inclusion of innovative methods of learning and teaching which are not so often in use by teachers. Most of the teachers teach technique as their second subject, on that matter and regarding small quantity of lesson hours, it gets secondary meaning. Classical method of teaching is used most commonly by explaining the learning materials on stock and by manufacturing the product on teachers' choice, where student can not developed creativity. Classical lesson of technique and its characteristic frontal form of work is used too often.

ISSN 1822-7864

Problem of Research

Students in today's Primary School have for a one third less hour's regular study of technical education, and in the last year even none. (Study plan, 2011) There is a small interest for technical contents among students. Until the year 2011 at most 30% of students decided for alternative of robotics in technical education, after our activities, this number increased for nearly 10%. (Figure 1) Methods of work and contents needed improvements and renovations. There is needed a balance between using methods in technical education to ensure the best efficiency.

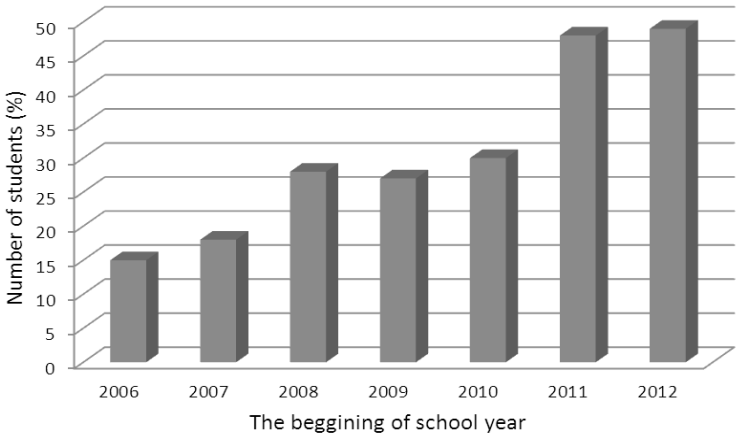

Figure 1: Number of students at selective subject.

There are some activities to increase the interest for technique:

1. At disposal is an interesting and exacting product.
2. Methodology Didactic of learning theory named after Heimann is used for theoretical starting point (The Berlin model).

Research Focus

Didactic of learning theory, advanced version named also The Berlin model, is one of the models of general didactic, which is because of its direction in activity, suitable for use in areas of technical education. It was founded in years from 1960; and its leading members were Heimann, Otto and Schulz (Aberšek, 2012).

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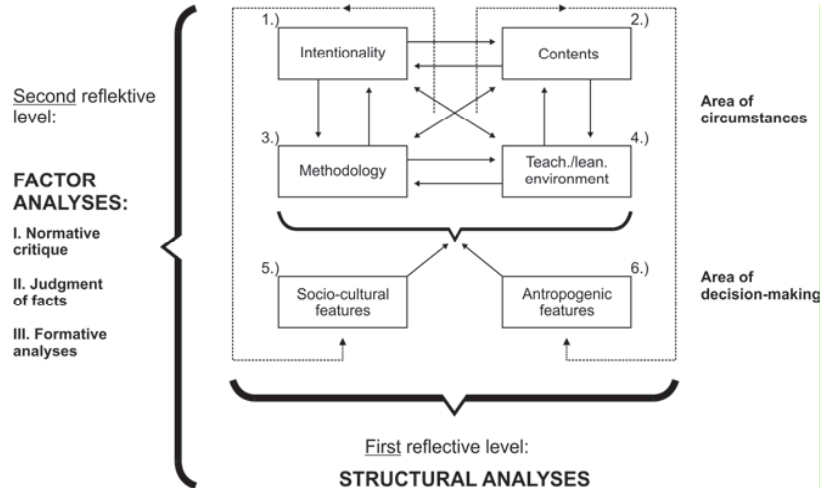

Figure 2: Structure analysis (Heimann, 1976).

It puts "structural analysis of study lesson" in the center and with this introduced only one of many element didactical theoretic construction. Established continuances (intentionality, contents, methodology, environment, socio-cultural features and anthropogenic features) at observing this study lesson can be a motto with analysis like also at the planning of study lesson (Heimann, 1976). The most important constancies were considered in our planning of a study lesson.

"Key assignment of didactics and its elements is a description of suitable courses and preparation of adequate means, which should be selected and used by teachers in order to realized goals at lessons of technique as soon as possible and with highest rates of efficiency. Teachers should conquer the methodical competence, which means that they must know the methods of didactic at technique as well as suitably chose them and use them, like so as needed adapted them in correlation to admitted goals and their students" (Aberšek, 2012:141).

The teacher should not explain the theory, but dedicate most of his work to practical work, which includes theory. Goal of study lesson is, that students at the end understand what teacher intended to disclose. Gaining of exacting knowledge is possible at study lesson by using the Heimann's methodology as a starting-point (Landsiedel, 2001).

Our research adapts the model for the current situation and needs inside the class. The student is placed in an active role, as regards his experiences and looks for achieving the higher recognisable goals. Motivation encourages his persistence at confronting with new challenges and like that eliminates one of the major problems in teaching the practical activities in the class.

Proposition of developing the lesson hour has been introduced on a case of modern didactical model, which explicit boundary of goals, contents, methods and resources. It is remarkable for differentiation between analysis of situations and areas of decisions. This example was started out of the area of electronics, where the students can achieve working operation of soldering and through that meet some basics of electronics. Learning process was performed in Primary School Bistrica, with 15 years old students (9. Grade). The theme is: Manufacturing the product from the field of electronics – Moving bug. Short description of the process is:

1. Analysis of studying situations

Social – cultural characteristics (In what kind of a study situation will I act?)

There were 16 students in the group, 15 of them were boys and one girl. Students are coming from the rural territory; only rear of them has been confronted with electronics and wired circuit. There are certain circumstances in every class that teacher defines them as "atmosphere in the class". Even certain School affects on the atmosphere and creates special circumstances. Teacher must adjust to them and respond with his own way of handling.

Anthropological characteristics (Whom will I transmit?)

Students are visiting the 9. Grade and they are 15 years old. They are finishing primary School and they are deciding for their further education. Because this group chose this subject on voluntary basis, we assume that they are interested in this theme. All the students have some knowledge of working with metals and electricity which they gain at classes of physics and technical education. Most of them had never before soldered a circuit. Soldering is adapted to their abilities. We will get to know about the electrical parts during class, just as much as it is necessary for the product to operate.

2. The areas of making a decision

Deciding on the international area (With what purpose are we doing something?)

Group of students more or less successfully submit the procedure of soldering electronic parts to the wiring circuit, operating of some basic elements reading of electrical plan and one way operating motor. Students developed skills at practical work and also persistence, innovation and accuracy. They get used for team work, sharing of work assignments, saving the energy sources and environmental care.

Deciding on the thematic area (What am I going to transmit to the students?)

After analysis of the state in the classroom I discovered, that students wish to make the product by themselves and it should be moving by remote control. The purpose of teaching is to gain more complicated knowledge from area of electronics. While producing the product, they can easily explain working of some partial elements and at the same time learned new working process from the domain of metals.

Choice of learning methods (How will I do it?)

During the process of teaching the transfer of knowledge into praxis took place. The demonstration, explaining, practical work, dialog, debate, work with text at description of the procedure was used in order to analyse the product at testing.

Use of resources (With what means will I make it happen?)

A sense was used by planning, the inclusion of intelligent study environment into practical work. In experimental group was used a computer program for the demonstration, where all procedures took place in order, in pictures and words. The data and additional information has been searched with help of electronic (the world web research) and printed sources. As three dimensional learning mean, it was used as a model of made bug and a material for making it.

3. Planed process of study hour – modern didactical model of technical education

At first motivation was needed for the students. The pictures of products that we plan to make and the videos of robots in motion should be closely inspected. Then the demonstration of sequence of operations and their specifications were instructed.

There is needed a precaution at giving the instructions. Right after explanation of the instructions, occurred the questions:" What should we be doing?" Constantly repeating of the same things toke us a lot of precius time, that is why we toke us some time and stick to useful instructions: students get still, we transmited the instructions, they repeated it several times, when the work was done we cleaned the working space, we helped the students during work (Paterson, 2003).

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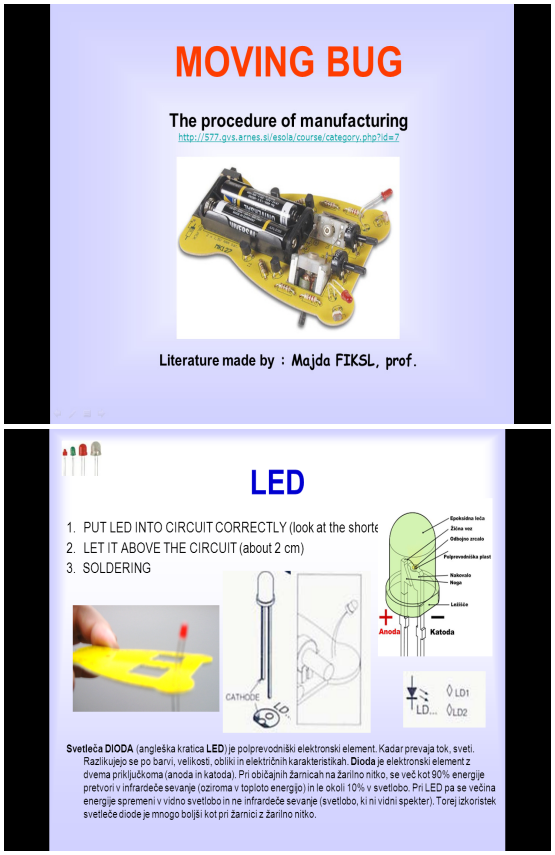

Figure 3: Instructions for self steamed work step by step in working process.

At the demonstration and giving the instructions the introduction of making the product by steps was displayed (Figure 3). Every phase was exactly showed with a picture and described by points. At the beside there were written warnings on which we should be especially careful at mounting every special electronic part. All the knowledges about electronic parts were strictly explained during working hour.

At the end some tests were made. It was necessary to darken the room and operated robot illuminated with a flashlight. Around placed obstacle robot was guided with a flashlight from the beginning to the end, also the time was measured. When the robot followed the light our assignment succeeds. Speed decides the winner. The robot could be turning only one way or not at all. That way it was needed to be fixed. Finding out how does it function, evaluates them and prepare them for the competition.

Methodology of Research

Particular hypothesis:

1. Our assumption is to get assumed goal with modern didactical model and that our robot will operate faultlessly.
2. Our assumption is to get higher cognitive knowledge and durability of knowledge in a short period of time with modern didactical model, because we have time limitations at our lessons.
3. Our assumption is to get higher motivation of students and higher popularity of the subject with the modern didactical model.

To research the effect of teaching, experimental method of traditional empiric-analytic pedagogic discovery was used. Descriptive method was used for collecting the data with help of sources, non-experimental method for question forms for student and experimental method for the experimental group (EG) and control group (CG).

Sample of Research

The research developed in round of elective subject in October and November of 2011 in two groups on Primary school Bistrica pri Tržiču. In the elective subject enrolled 34 students of age 15 years and they are visiting 9th grade. Elective subject duration is one year and can be sorted out by students only in 9th grade. Students were divided in two groups. The first group was named experimental (EG) and numbered 15 boys (94%) and 1 girl (6%). The second group was named control (CG) and numbered 16 boys (89%) and 2 girls (11%).

Table 1. Number of students.

	Experimental group (EG)		Control group (CG)	
	f	f (%)	f	f (%)
Students	16	47	18	53

There was substantial input of modern teaching method into an experimental group adjusted to students, used modern study media and constantly adding theoretical knowledge during practical work, when there was needed. Student created their own knowledge. We must give the opportunity to the students, to learn through experiences, only on that way they will get creative and will reach higher cognitive knowledge. There were no changes made in control group, it was used classical method of teaching, based on frontal explanation with supplementation of knowledge, demonstration and effected on students unmotivated.

Instrument and Procedures

Technique of collecting the data was a short inquiry form with numbered three grade estimating scales. In this form there were exposed three areas: operating used time and motivation. Variables were judged on three scale levels. At first we were interested in how the robot was operating. It can be answered only on three different ways: it can operate or not, it could also be in short-cut. Three different alternatives can be offered: great, good, needed corrections. Students were asked about the time of manufacturing and they were also given three possible answers: 6, 7 or 8 hours, supposable nobody needed more or less time. Afterwards they were asked about their satisfaction (motivation) after the work was done and for answer supplied them three grade estimating scales. Short questioner was assembled from two parts of questions. First part attended on demographic variables: class, sex. Because of popularity of technique among boys and girls, sex was also our interest. Second part was judged by variables: product operating spent time for corrections, motivation. For exhibiting the lesson there was prepared a new modern didactical model-preparation for teachers which included modern methods and media.

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Results of Research

Students made their product independently, which satisfy all requirements: it was done in a certain time, using the selected materials, choosing efficient techniques, justified evaluation and with safe use of tools and additional substitutes. The control group asked many more questions, needed so much more help at work and they used for a one third of time more to make the final product. The experimental group had a chance after the teacher's demonstration to take a continuous look at the additional explanations on e-Manuel at the computer, where they made sure that they are working correctly and knowledges about the needed elements were transmitted, when they needed that information.

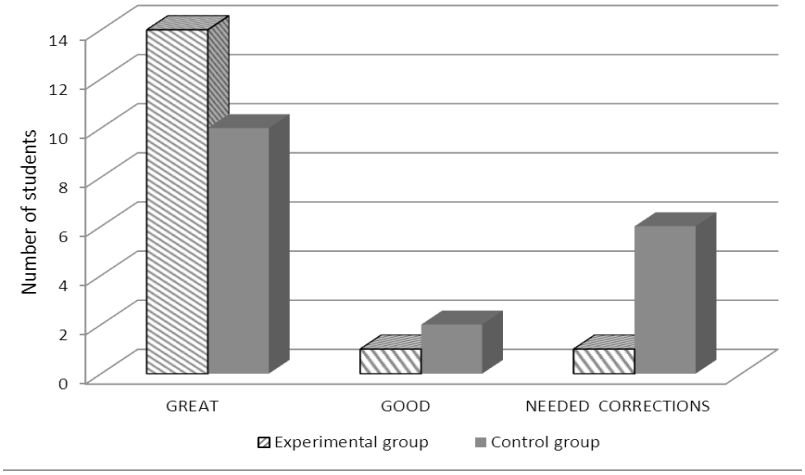

Figure 4: Operating of the robot.

After the end of work, the students have been asked how their individual robot was operating. (See Figure 4.) 16 students from experimental group answered the question, 14 (88, 0%) of them evaluated that their robot operated outstanding, 1 (6,0%) student evaluated his robot just good and 1 (6,0%) student accord that his robot needs several adjustments. 18 students from control group answered the questions, 10 (56, 0%) of them stated that their robot was working great, 2 (11,0%) stated that the robot was working fine and even 6 (33,%) students needed to repair their robot.

Discussion

The lesson is a compound of two connected activities: teaching and learning. It can be noticed a difference in result of work, spent time and motivation for technical subjects, from comparison between classical and modern lesson. Quality planning and performance are the most important facts for modern lesson.

According to data inside the group it is discovered, that every group has only few girls which decides to take this technical variety. Products made until now at elective subject were most appropriate for boys, they were interesting enough also for girls, that is why there is such lack of interest among girls of elective subject of technique. By now elective subject visited only few girls, for them is in a future planed attractive choice of products. Such products for instance: beating heart, new years frosting and decoration, stars.

ISSN 1822-7864

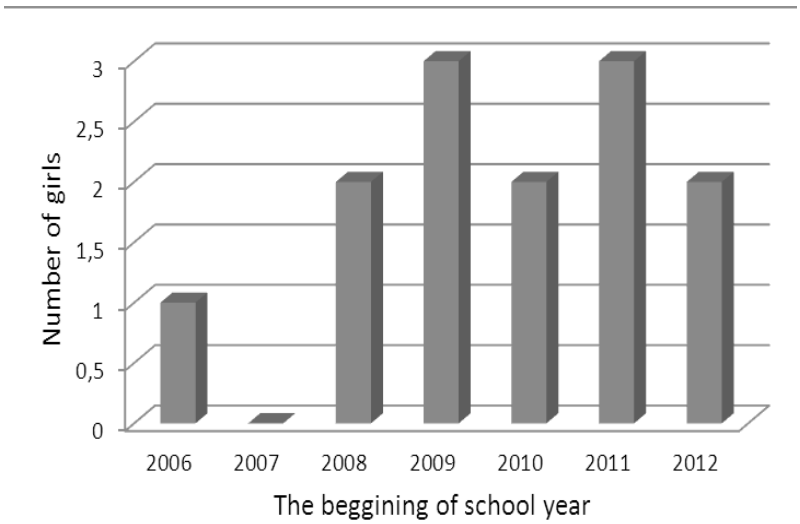

Figure 5: Number of girls at elective subject.

Conclusion

Improvements at the lesson of technique were disclosed incorrect use of the working methods and assortment of an interesting product. An experimental group of students worked better, faster and at the end they were much more satisfied their achievements. Popularity of the subject was compared with different methods of work. An experimental group of students was highly motivated for further work.

The transfer of theory into praxis with help of advanced learning environment after developed mode will enable the teachers to have innovative access towards teaching, which is closer to students and at the same time guaranties and encourages quality. Fitting didactical strategy and reasonable including of this approach in teaching has an influence on persistence of knowledge of students.

Advanced learning environment appears as equal factors of study lessons, which are in the special communications function at realization of study goals for certain issue and besides teaching methods contributes to the teaching progress. Students are learning more individually, gaining experience and knowledge of the way that creates a pleasant pedagogical atmosphere so that makes possible among others more creative relationship to work. With manufacturing these more complicated products we are developing lifelong learning process (Peklaj, 2006).

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Received: *May 15, 2012* Accepted: *July 26, 2012*

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ISSN 1822-7864