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Technical training for the use of project-based teaching

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Abstract

We have been working as teaching staff for years and we can responsibly say that many of the present students lack the technical or logical thinking. That is why we are convinced that even in the area of general subject we can support technical education, through appropriate tools. Why do we think so? We are convinced that present modern days are full of technical resources. That is why we can use these technical resources even in teaching of "non-technical" subjects and to use their function to introduce these technical resources to the students. We are facing the situation where society is developing quickly and it is transforming from the modern society supported by information and communication resources towards searching for the spiritual dimensions and the essence of its being. One of the many conveniences of today is the possibility to implement modern information technologies into teaching. Students will learn not only handle these technologies, but also to use them. There are very convenient elements that interconnect general education and technical education – project learning or problem learning.

Keywords:	*Schlüsselwörter (German keywords, optional):*
Technické vzdělávání	Technische Ausbildung
Projektové vyučování	Projektunterricht
Projekt	das Projekt
Strategie řešení	Strategie-Lösungen

1 Introduction

Implementation of the technical resources into project learning in the system of transmission of information (we mean learning process) creates an interlink which interconnects clarity of teaching with practical elements. These technical resources can be physical or also digital. Digital technical resources show clearly the learning problem to the students using educational programs. When we concentrate on the computer programs and all the study materials written for the individual subjects, they offer the students better clearness of the curriculum and they are also more attractive for some of them. We must add that the words "for some of

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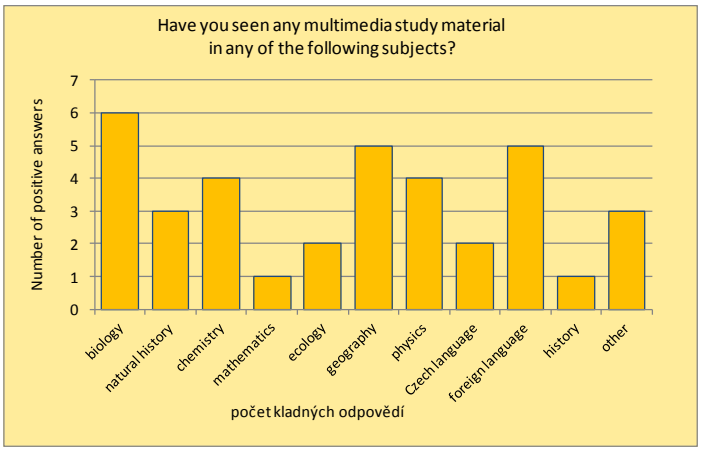
them" are used deliberately, because mini-research we did in this area showed that not all of the students prefer these technologies. Either way, the usage of multimedia technologies is increasing. The general reason for creation of multimedia learning materials in all the teaching areas is to increase the efficiency of teaching of individual subjects, improvement of the school facilities in the area of modern tools, etc. There are subjects (such as for example geography, biology) that can become much more attractive in the multimedia form than in the form of classic teaching. Our research in the schools of Zlín region clearly shows that multimedia materials previously prepared do not equally /Picture 1/.

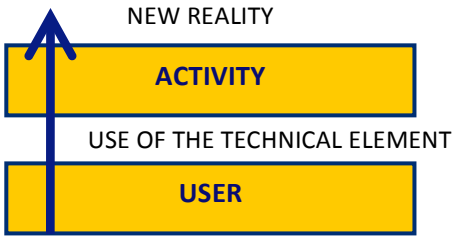


Picture 1: Substitution of multimedia texts in taught subjects

2 Technical versus general education

Because technical education is one of the components of the general education, its involvement in teaching gives students understanding of the purpose and importance of technology, technological activities, their main components and its course. The technical education also promotes and develops the psychological and manual potential of the students. The acquired basic technological skills enable the individual to properly orient in the situation when he gets in touch with technology or technical object. That is when students becomes its user. Another factor which shows that technical education becomes important is the necessity of the user to apply the technical element into some activity of his on his own, or when he wants to create new technical element on his own /Picture 2/.

Picture 2: User of the technical element



Picture 3: User of the technical element through which new element is created

When we speak about technical education as part of the general education, we think about implementation of the technical elements into the process of teaching and this can be done through project teaching or using the problem teaching. One of the technical elements in the present education can be the implementation of ICT technologies. Students can (are forced to) use also additional tools, such as cameras, stereopticons, tablets, etc. Using of these technical aids greatly influences and improves understanding of the student - processor. The teacher works in this process as a consultant and coordinator. Great changes are required from the teachers, changes of approach. The teacher becomes manager and he must understand that responsibility cannot be ordered.

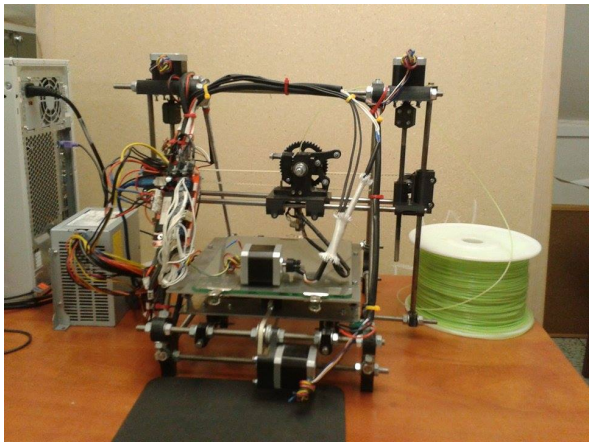
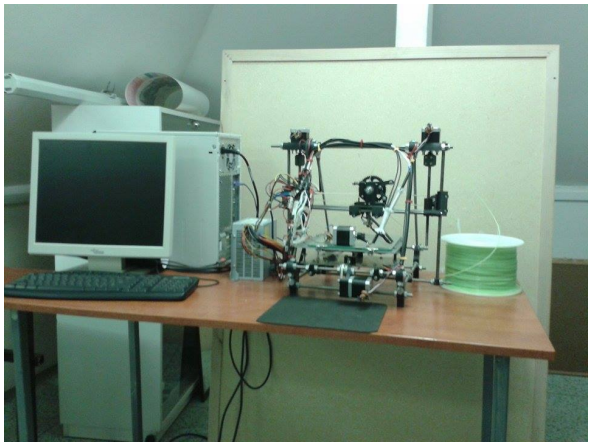
2.1 Project, problem and teaching role

Students are learning in many different ways. They are often introduced to the situation where they have to face obstacles, they have to solve a problem. We can understand this problem as the conflict between the actual situation of the student and the goal that they should reach.

The term project, as well as the term problem can be understood in various extents in the pedagogical context. Dewey pedagogical concept became the basic for processing the curriculum into problems. Dewey and Kilpatrick characterize the problem as:

- Curriculum modified in a way to provide many opportunities for thinking, forcing people to think, evaluate, sort and to draw conclusions,
- Concentrated on the student's intellect, but standing outside the student,
- Call for answers,
- Solve the problem itself, does not emphasize its usage.

The present pedagogical bibliography understands the problem most often as problem of theoretical or practical nature that student must independently solve through his own research using any means available. The student abides given needs, heads towards overcoming difficulties, thus gaining new experience and new understanding (Okoň, 1966). One of the long-term problems being solved is final graduation works. Mainly in the technical study programs, student is required to present the result of his work in the form of finished product, in which he will use all the knowledge acquired during his studies.

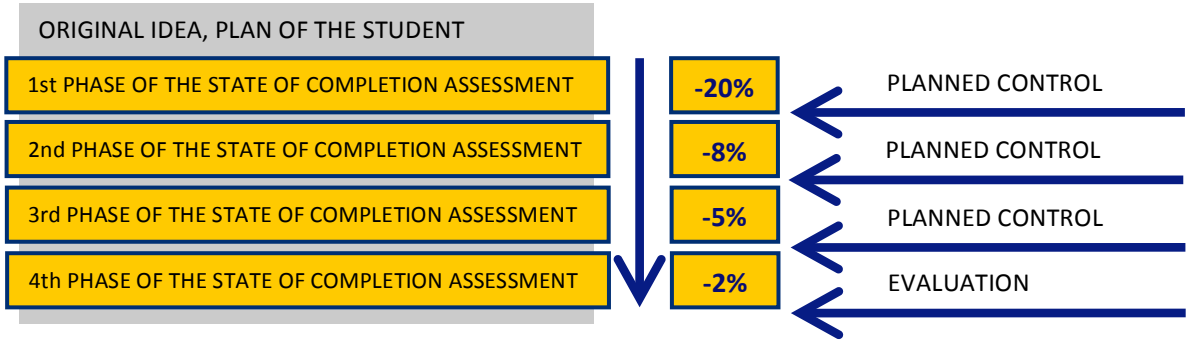
Picture 4: 3D printer – sample of the final practical graduation works in our school

Also during the study itself, it is possible to implement the problem elements or to prepare the lessons based on project solving. Implementation of project teaching or problem teaching gives the lessons elements of playfulness. The play is the activity that influences the earlies development of human. Technical education can be implemented also in subjects with non-technical nature. It can be in subtle form, where students use technical tools when working on projects or solving problems and they have to learn how to use these technical tools. The technical tools can be cameras, tablets, computers or other technical elements. As you can see in the pictures 2 and 3, we can use the technical element as support tool, or we can use technical element to create completely new element which can be used to create new reality. Project is usually much wider and systematized problem and as such, it did not include just the basic problem, but there are many partial problems – steps that must be solved first to enable the basic problem solution.
We must distinguish between problem and learning task, which means some requirement for the active theoretical or practical activity of the students in the form of exercises, questions, etc. Learning tasks can have different levels of difficulties, but their solution is not based on searching for and finding of something new.

3 Project as specific educational strategy

We cannot understand project as isolated element of pedagogical activity. We cannot expect it to exist in isolated form. When we consider the educational system as the basics, then project has different functions in this system. These functions of the project can be a method, a tool, a means, an environment, a strategy, etc. The project also creates bonds with other elements of the system, for example between informative teaching and heuristic teaching. If we implement projects into the lessons, we must also consider that educational process has educational and training function. Our experience with projects in educational process shows that correctly chosen and implemented projects can become one of the tools that will help greatly to induce

optimal climate in the given teaching hours, creating good environment for the development of the student. It is also an indisputable fact that if the project is appropriately introduced into the lessons, it gives space for the solving of the project itself and then for reaching the requested results and their evaluation. The teacher is expected to allow the students to show their own initiative, creativity and also to be able to show their own



Picture 5: Course of the project processing and continuous filtering of the original processing intent (regulation of intent)

organisational skills and abilities. Their initiative can be for example choice of their own topic for solving. Another initiative that students have can be also the choice of technical tools for processing the project. During the processing of the project students have to somewhat correct and specify the original intent. The analysis and observation of the students' work on the project or problem tasks show an average of 35% of leaving the original intent at the point of entry (see Picture 5). As you can see in the picture, according to our experience and mini-research, student has to compromise up to 35% of his original intent that he had when project was accepted at the beginning. It is not uncommon. As we wrote before, the student is influenced by different objective obstacles during the processing of the project, forcing him to modify his original ideas. But it is necessary from the viewpoint of the teacher not to depart from the original project outline.

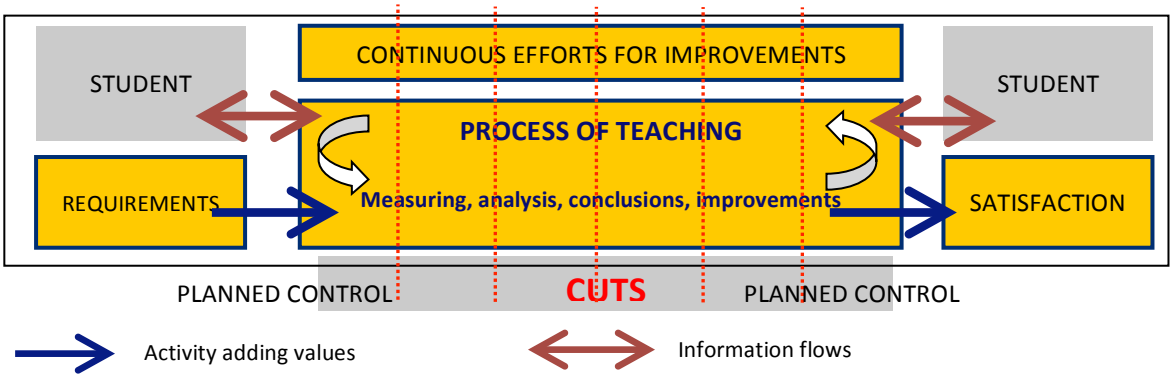
4 Monitoring the efficiency of mastering the curriculum in the project teaching

The main task of the present teachers is to continuously seek for the modern didactic methods and forms of teaching. As we can see in the results from abroad and partial results in our country, project teaching is one of these tools. Indicative verification of the efficiency of using project teaching is continuously implemented as own initiative of teachers. It shows us the reserves that we have in our style of teaching and we expect that it can lead towards further development or at least show us what parts of the teaching we should concentrate on more or that we can change. Our effort is to provide the feedback. We are trying to learn about the efficiency by comparing the results of task solving in two groups of students. The size of the groups of students makes it possible for us to create such groups for comparison. We suggested not to monitor the efficiency at the end of semester but during the semester. The working title for this continuous evaluation of the efficiency of project teaching and classic teaching is: Monitoring the efficiency through cuts. Verification of the project teaching influence is done immediately after finishing the project of the given topic, but also globally after semester. We had to define two working hypotheses to evaluate the rate of mastering the curriculum:

1. Both compared groups have the same starting knowledge
2. Group of students, which "learns" through project teaching will have better final knowledge

Because the rate of the knowledge acquired by student is not directly measurable, we can evaluate it only based on the tests or questionnaires. We do not wish only to compare both groups, but to improve the teaching in the chosen subjects. That is why we try to acquire the requested information through anonymous questionnaire and tests, information that will be used in our further didactic activities, in continuous improvements of the study texts and continuous improvements of the quality of teaching. We can say in general that using the forms of project learning in the region of the Czech Republic on higher degrees is insufficient. This situation was shown by our internal data. Another insufficient situation is in using of feedback. We tried to prepare graphic model of monitoring the efficiency of acquired knowledge. Student is tested in the form of cuts as part of the project teaching and the results are then evaluated, resulting in modification of the

influence and study materials. We learned about project teaching that it gives added value to the learning process for the students. We can learn about the efficiency of the students' learning through internal or external evaluation, but also the combination of both evaluations can be used. When learning about the

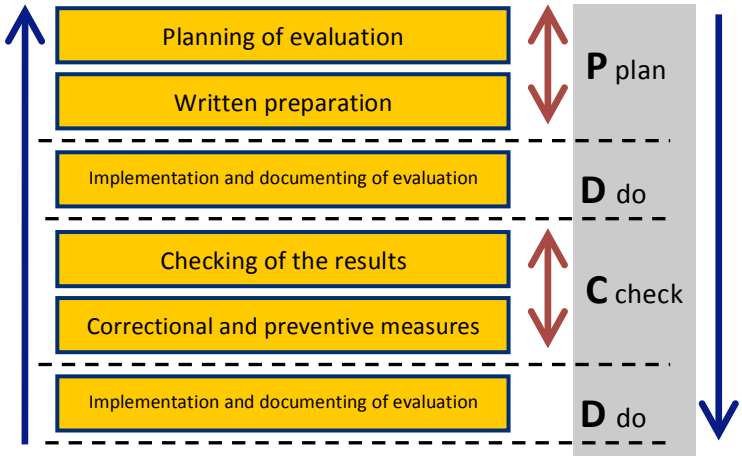


Picture 6: Model of monitoring the efficiency of mastering the curriculum using not only project teaching

efficiency of the process of learning we can also suggest using the control loop (PDCA), which is used by the evaluation of the quality system by auditors. We modified the PDCA control loop to evaluate the system of learning. Planning of evaluation is prepared in advance. It includes mainly the study of documentation for studying, study of evaluated problems, curriculum schedule, creation of questionnaires. The implementation is based on going through the completed questionnaires, learning about the state of completion of the projects and records.

The control summarizes the findings, records disagreements, evaluates the process of learning and learns about the value of added value. The measures based on the evaluation lead to rectification and possible prevention. The control loop is shown in the picture No. 7.

The data we have acquired so far show that the process of learning the curriculum is increasing with increasing implementation of project or problem teaching. We cannot present the results of monitoring yet, as we do not have enough base data. We successfully used the modified PDCA model. We are continuously forced to complete and innovate the project tasks, innovate the multimedia texts for students and to improve the individual approach towards students. Another important finding was that not only improving the individual project tasks is necessary, but also improving the test and questionnaires is very necessary. To acquire more information needed for our work, we decided to try and implement project teaching also into other subjects and also to try and create project tasks that will connect more subjects. Such connection of subjects seems to us as very helpful, as it gives students possibility to implement more knowledge at once and shows them interconnection between different subjects. It will at the same time increase the sample of researched students and we will be able to improve our current teaching.



Picture 7: Modified model of the control loop PDCA

5 Conclusion

Our present results show that project teaching is very good form for gaining of knowledge for students and also very good form of applying the theory into practice. Project teaching adds some added value to the basic teaching, in the form of organization of activities by students, management of the project, evaluation of the

participants in the team, control of technical tools used in processing the project or problem task. This is where we see one of the possible and for the present time very important possible way of teaching that enables implementation of technical tools for processing of the tasks, or implementation of these technical tools to create new tools that will contribute to the solved task. Students of non-technical fields of study can use this form of learning to easily learn about technical tools and use them in their work. Based on our experiences so far we can say that students themselves often bring original ideas and what is important, they have a pleasure of their working.

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