PROJECT AND PROBLEM BASED TEACHING/LEARNING BY TEACHER STUDENTS

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Project teaching is an organization form which overcomes the limitations of routine teaching: detachment from everyday life, isolation of subjects, alienation from pupils' interests, the prevalence of cognitive teaching and low motivation.

Educational projects integrate different topics and give the opportunity to seek and find crucial links and connections that are needed for problem solving. They enable everyone to apply and develop their skills, to be useful, to cooperate, to discuss, to be able to accept and evaluate others' opinions and experience success. Working on a project invokes the students to solve one or more concrete, meaningful and real tasks – therefore, school becomes part of life.

In project teaching, a situation, which represents a real problem for the students, is chosen. The plan of the problem solving process is discussed with the students, questions are formulated and specified and activities, which require particular problem solving are performed. Work on a project is divided into activities that are done by individuals or small groups of students either in the lesson, or, more often, outside the class and school. The time needed for fulfilling a project cannot be set. Time should be flexible in order to let new problems and questions, that occur during the process, enter Work becomes entertainment for the children and it gives them not only new knowledge, but also satisfaction. It is necessary to keep putting new ideas and inspiration into the project and observe thoroughly when the students' interest level is falling. Self-reliance is essential, and becomes evident when formulating questions and problems. Usually, when assesing the students, performance is not considered and marking is not used.What is taken into consideration during assesing though, is how the students are proceeding, how they formulate and verify the hypotheses, and the way they present the results. The students themselves take part in this assesment.

Projects can be divided according to the focus (strictly theoretical and rather practical), time, intersubject relation etc.

Types of projects according to time:
Long term (several weeks or months)
Medium term (a few days up to one month)
Short term (a few hours up to one day)

Project planning process:
Choice of the topic
- age, resource and students' level adequacy
- interesting, natural and true topic

Goal and outcome
- must be concrete, real, interesting and useful

Motivation
- the way, age and enviroment adequacy is important
- the continuous motivation, the younger the student is, the more frequent and diverse the

motivation is necessary

Material support
- tools –availability, reality
- tools which the students gain from different sources (home, internet etc.) are also expected

Realization
- choice of subjects integrated
- work organization
- motivation
- brainstorming
- alternatives
- ways of proceeding
- rules
- time layout
- teamwork
- individual, group work
- assesment in the process
-assesment at the end
- presentation
- conclusion

The importance of project teaching:
it provides a natural and spontaneous way of new knowledge gaining
it is oriented to real life needs
it is close to J. A. Comeniu´s idea "Schola Ludus "
it respects the possibilities and individual needs of the child
cognition is connected with a more intense experience and is therefore better stored in the memory than knowledge gained vicariously
it helps the child to develop comprehensively in the real world
it developes one's concentration
it teaches the children how to cooperate and communicate
students have a better opportunity to express themselves and to formulate their ideas
a mistake is a way to search for a different solution
mistake correction is done without stress
oral assesment serves to inform the students, teacher and parents
the teacher is a partner to the student; teachers help to develop the individual qualities of the student
the teacher respects the possibilities, interests and needs of the student

The project is a part of the educational program which is presented to the students in a different way and penetrates into several subjects. It is based on the pupils individual work done mainly outside the school.

Students of the Pedagogical Faculty UJEP in Ústi nad Labem whose major is teaching

will complete their pedagogical internship, during their studies, by teaching in schools for a few weeks. The internship at the Pedagogical Faculty is organized and methodically led by the Centre of Pedagogical Practice.The students are led to use new methods and approaches in their teaching. Project teaching is one of these tasks.

Examples of projects made and completed by the students of the Pedagogical Faculty UJEP in Ústi nad Labem majoring in teaching during their pregradual pedagogical internship. Similar project are made in science teaching.

Universe- the solar system

Goal: to infer the term "solar system", to approximate the word "universe", to learn how to search for information on a given topic, how to sort it and present to others

4th grade in basic school (9-10 year olds)
a medium term project

Types of Activities:

1.Introduction of the project, motivation
Project introduction, formulation of questions, extrapolation of tasks
Division of tasks into tasks for groups and individuals

2. Collecting and sorting of information about the solar system
Reports on interesting things about the universe
Documentaries about nature (VCR, CD)
Groups, each group gathers information about one planet

3. Gathering of information about the solar system/ Universe
tasks for small groups and individuals:
Choice of the time of excursion at Planetarium Teplice
Financial calculation
Information about aim
Information about history
Dividing of tasks performed by excursion
4. Internet
Information about the universe
shots from the universe watching
models, simulation of planets orbit
other things in the universe
eclipse of planets

5. Topic: The universe in a lesson
Czech language- work with words and sentences universe-focused
Essay writing- an essay on People and the exploration of the universe
Math- word problems dealing with the universe, distance and speed calculation etc.

Reading- atlases and and encyclopedias about the universe, magazines, chosen articles, sci-fi literature
Geography- planetaria in the Czech Republic, history, information about the greatest discoveries, significant personalities, history of astronautics, significant astronauts, relevance of the universe exploration for life
Biology- encyclopedias, students` reports, movie, photos, CD
Art- model of the solar system, aliens, a fictitious planet
P.E.- playing of well-known games with relation to the universe
Music-listening, fiction-music from the universe, singing of aliens

6. Excursion to the planetarium in Teplice
parents` involvement
a guided tour of the planetarium
observation of the sun, (night sky with the parents)
watching movie about the solar system
conclusion

7. Presentation of the outcomes
Pin board in the school corridor- pictures of aliens, model of the solar system
Pin board in the school corridor- astronautics
Presentation on school`s websites
atlas of planets consisting of sheets made by the children

The day of the tree

Goal: nature preservation, a tree structure, respecting of the nature, self-examination

2nd grade in basic school (7-8 year olds)
short term project - 1-2 days
Types of Activities:
1. Motivation
a story about a tree read out loud by the teacher
flipping through the encyclopedias in pairs
trees- differences in kinds, its description
consideration- What would I do, if I were a tree? ; children think about the needs of plants (to learn how to communicate and listen to the others)

2. Stroll in the woods
on the way- rhyming on the tree`s name
grove- children are given a card with a picture and the name of a tree (pine, fir, oak, birch), their task is to find their tree and to create a grove with the trees of the same kind
task: find yourself a tree, examine it, touch it and talk to it
talking about individual feelings

3. The school tree
the branches collected during the walk are arranged in the classroom
In groups children draw or write down briefly on flashcards what is bad for trees (red card), what is good for trees (green card)

The cards are then hung up on the "school tree" along with a few blank cards that can be used for later ideas

Continuously

a tree is growing (exercise for the pupils when they start to be tired)

4. Individual tree

individual task: each child will draw an outline of a tree accompanied with his qualities (weaknesses and strengths), this anonymous work will be handed in to the teacher
analysis of the trees- discussion on the qualities listed

5. talisman

Pupils` homework was to bring their talisman (something natural) to school, they speak about why they chose that particular thing
second task is to draw a tree on a piece of paper to create a class grove

6. outcomes, conclusion

the class tree
the class grove on a pin board

Examples of other projects successfully completed by students

Car Dealer

the goal involves: how to behave in a store, calculating the price, consumption and distance, car makes, ecology, searching on the internet

Presentation of the class on the internet

goal: class home site creation

Money World

goal: numbers and currencies practicing, doing shopping, expenses planning, information about foreign currencies. Simulation of shopping, going to a bank, post office, etc.; shopping for real

Water, Water, Water

Goal: infer the states of chemicals and temperature measurement, Celsius and other scales, temperature taking, weather, climate

From past to the future

long term project
goal: historical periods` introduction-clothes, customs, food, political establishment, significant events etc.
Each period is an individual program.
individual search for information and its presentation to others is stressed. Every period is concluded with a vivid simulation of that particular period including costumes etc. The outcome of the project is a dramatical performance (may be also unreal) depicting a scene from a certain period. This is performed for other classes.

World creation - a man

goal: learning about life periods of a man, somatic, psychical and social differences

Future town
Ecologically aimed project. Conflict between increasing needs of a man and devastation of the environment- our basic need.

Results of the Project teaching
Children generally accept the new methods with pleasure. The projects and their application are a great success thanks to presenting of new information in a natural and easy way and also because the projects` outcome is real and often presented to other pupils in the school. It gives the child feeling of being successful. Collective and group work is very attractive to children, it enables the social and communicative abilities to develop. Parents were often involved as the work was done mostly outside the school. They were supporting the projects and often took part in them. Work on a project, its preparation and guidance are very demanding for the teacher. The students themselves considered the projects very successful, nevertheless they had often remarks on their own work. Their failure, though, was mostly caused by lack of pedagogical experience. Comments of the teachers like: "The next project I will prepare better" are a good sign of willingness of teachers to accept this new method of work.

DESCRIPTION OF THE WORKSHOP

STAGE NO. 1 – DEFINING THE PROBLEM

On the one side we have a class or a team, on the other side a precisely formulated problem.

The participants of the steering committee meet and after a few words of warm welcome, they are informed about their responsibility to act as representatives of their regions in future negotiations concerning the strategic plan that should radically change the development of tourism in the Ústí Region and in the participants´ regions. Their main task is to propose **strategic goals** for the development of tourism, the **priorities and measures** that would ensure the required changes.

At first the participants of the strategic meeting are asked to look at the following areas of tourist development in our border regions and select only three of them – the three issues they will deal with in their future research.
The following seven topics have been proposed:

1) Sources and Products of Tourism of and the Image of Tourism in the Ustí Region/in the participants´ regions;
2) Publicity Materials and Building Image of the Region
3) Sale of Tourist Products
4) Price Policy of the Region
5) Human Resources
6) Organisation and Management of Tourism, Conditions for Tourism,
7) Sources of Financing

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10) Sale of Tourist Products
11) Price Policy of the Region
12) Human Resources
13) Organisation and Management of Tourism, Conditions for Tourism,
14) Sources of Financing

To reduce the width of the topic, the participants of the meeting may, for instance, decide on dealing with Items 1, 2 and 5 at this session. The next part of the workshop will therefore focus on the three underlined areas of tourist development.

The work starts by the "presenter's" eliciting opinions (the teacher plays the part of a representative of the regional authority) from individual members of this "international team of experts". Each member of the expert team is provided with three small pieces of paper and is asked to jot down his/her ideas (brainstorming) connected with all above mentioned topics: *NO. 1 – Sources and Products of Energy production, No. 2 – Publicity Materials and the Image of ČEZ, No. 5 – Human Resources.* I expected to comment on both strong features and weaknesses that appear in these three spheres of Energy. He/She can also make some proposals for the production of energy in his region. Thus each member of this team should bring ideas that will be taken into consideration in the following stages of their work on the assigned problem-solving task.
This activity should last approx. 8-10 minutes in the real classroom conditions. The method of brainstorming enables to use the deductive thinking. The participants of the meeting will map several areas of the problem. The organiser will collect written ideas (answers, comments, notes, etc.) of individual members of the team and divide them into

three different piles (I, II and V; *classification*). The whole class is then divided into pairs and their work opens a new stage of the strategy.

STAGE NO. 2 - PAIR WORK

Pairs of students/pairs of the seminar participants will have approximately ten minutes for the solution of their new task – the elimination of answers or reactions frequently repeated and the preparation of a short report on individual students´ answers. Students/Participants exchange basic information in pairs, comment on the ideas written on the sheets. One member of the pair (the speaker) is then asked to go to the blackboard (or the flipchart) and briefly record the results of brainstorming. He usually writes down a list of basic/most important ideas and comments on them in a brief oral presentation. Thus the pair work usually results in defining and analysing the main problem spheres of the respective topic. The pair may also set standards for choosing the best solution.

STAGE NO. 3 - GROUPS OF FOUR PERSONS

The organiser then forms groups of four persons dealing with the same topic. They assemble in front of the board/flipchart with the lists of generalised items. Now their task is to select the best solution paying attention to all necessary measures that will have to be taken into account with each item of the problem recorded on the flipchart. They can also set goals and output types, or target groups of population, sources of financing and possible ways of implementation. They may propose several solutions available and focus on recommending one of them - the best solution.

STAGE NO. 4 - GROUPS OF EIGHT PERSONS

This time the group will grow into a larger team of at least eight persons. This stage will make use of the accumulated knowledge acquired in the previous problem-solving steps. Inside the team the discussion may be longer and again one representative of the larger group (the speaker) will be selected to report on final results of the discussion.

Members of this team define and analyse the problem again, set standards for the best solution, identify possible solutions. In the real classroom situation it would be ideal to give them more time (two or more weeks) for the implementation of the best solution, which will later be brought to the classroom for the final synthesis. Individual solutions of several teams of experts are confronted and the final solution is submitted (in the form of an oral presentation or written report supported by a series of tables and charts).

STAGE NO. 5 - THE WHOLE CLASS

The whole class reports on the selected solution, difficulties, the course of solution, and the used material. Individual members of the team are expected to assess the task and the teacher will assess the work of the whole class. The final stage also includes the process of self-evaluation of individual members within the team (each member’s contribution to

the final solution, description of shortcomings and difficulties that occurred throughout the problem solving process).
The time required for presentation of the whole 5-stage algorithm: Minimum of 2 teaching units, which will enable the teacher to show how the algorithm works in the classroom. The real problem-solving task may be assigned for a longer period for a couple of weeks. (Wedlichová, 2008)

APPLIED TEACHING/LEARNING STRATEGIES

At first students are expected to acquire and improve:
- *Principles of efficient study skills and reading*
- *Techniques of advanced research work with the aim of finding answers to problem questions.*
- *Methods of efficient cooperation/collaboration of problem-solvers.*

The teacher who decides to make use of problem-based learning must not forget to use a great number of strategies that will meet the needs of a variety of learners. The process usually begins with the teacher's direct instruction addressed to the whole class or small groups. Individual stages of solving the problem then focus on exploiting numerous strategies of co-operative learning. Students make use of guided Internet searches (in this case the Internet offers hundreds of websites of travel agencies, as well as sites of local and regional authorities planning such changes that are aimed at enhancing tourist development). The final stage of presenting the product of problem solving may include the following strategies: oral presentations, multimedia presentations, written reports, mind maps, tables (graphic organisers). During the whole problem-solving process there will be numerous opportunities for participants of the course/workshop to use all kinds of information technologies, such as computers, video and digital cameras, scanners and the above-mentioned Internet.

ASSESSMENT AND EVALUATION TECHNIQUES

One of the most important tasks connected with application of PBL is the continuous checking of the problem solving process by the teacher. At the very beginning the teacher consults students´ strategies by applying the well-established technique of "brainstorming", which usually reveals quite a wide range of topics covered by the learning team. The second possibility is to apply the method of "heuristic discussion" based on the teacher's skill to control the whole investigative process by a series of relevant questions. The teacher applying this wide range of questions becomes a facilitator who does not help to solve the problem but makes students compare facts, complete information or check the solution, and if necessary, lead them away from the wrong path. These questions therefore must be formed carefully to lead students to the confrontation of facts or doubts about the solution at the moment when they cannot prove its accuracy by a sufficient amount of facts or material.

The student gets the required experience from his own research activity. The teacher's regular feedback is necessary. The sooner the student learns the result of the teacher's assessment the better he realises his own growth in the process of learning.

During the application of the heuristic strategy, students behave as specialists in their field; In their looking for a solution of the assigned problem they become researchers, presenters of the products of their research activities, while the teacher facilitates and supervises the process and if necessary guides and rectifies its progress. This type of learning leads students to creating new roles and scenarios that require efforts of both individuals and the whole working team.

Therefore, the application of PBL also requires new forms of evaluation. Students, getting new roles, will have to learn completely new ways of evaluation of their work. The previous experience shows that students who are not used to new evaluation techniques often neglect the role of self-assessment. As a rule, they do not approach this problem seriously and are not objective when assessing the work of their colleagues. Our action research in this field should soon bring results that will show us the areas where we should think of improvement, as well as how we could achieve better results.

The teacher can ask how students assess themselves, how they evaluate the solution of the task, their cooperation on the problem solving process, or they can say what parts of the problem remained unresolved, what difficulties occurred during the whole process of learning, whether they succeeded in finding more solutions. Teachers' questions may also include the following spheres of interest:

- Use of creativity for the solution of the problem;
- Assessment of students´ inventiveness; or finding new solutions or less known sources or materials;
- Looking for more solutions;
- Types of questions asked during sessions, consultations and discussions;
- What processes of thinking have been used and whether generalisation has been included; etc.

If we want to make our assessment properly, we must include both summative and formative assessment. It means that we should take into accounts not only what the student learned about the problem, but also what activities he made use of, what procedures he applied to the solution of the problem. The assessor should also learn about the development of the work and motivation inside the group (cooperative methods of work).

If this method is used for further development of research and investigative skills, for the development of the student's talent and if focused on solving real problems, then it becomes a positive aid in educating young people.

For a university student, as well as a primary or secondary school pupil/student, it is a type of the "apprentice environment", which may, to a certain extent, simulate the real/authentic environment in which a great number of cognitive skills can develop in

each student. In a university student this activity is much wider and more complex, which also depends on the complexity of the problem task.

For each student it means to be equipped with the skills that will enable him to master the reading or studying of a wide range of materials with understanding, analyse these materials and confront them, learn to use the thinking processes of analysis and synthesis, create hypotheses and look for hypothetic and deductive solution of a problem.
Another problem in this area can be connected with the lack of time for mastering the required skills.

The student who works and acquires new items of knowledge and experience in the above-mentioned manner, will be much better prepared, acquires the precious awareness of being able to use the same method and techniques in his future career – it means that the teacher will lead his students to acquiring new facts on the basis of their own experience provoked or triggered by an interesting problem.

CONCLUSION

Problem-based learning encourages students to developing reasonable and independent work that can bring satisfaction and become a strong motivation factor. As shown above, this is a deeper form of learning. It takes place in the constructivist environment and places an emphasis on students´ independent learning and their gradual formation of managerial skills.

Students acquire new habits and new ways of behaviour that lead to solving problems. The approach makes use of the fact that students within a group acquire the feeling responsibility for the solution of the problem. This process will be effective namely where students are capable of defining their own learning tasks. The most difficult thing in this process, however, is the effort to define real or authentic problems.

The learning based on solving problems is now understood as an alternative approach used together with traditional methods. It enables, with the help of numerous research methods, to come closer to problems of a more complex character.

AUTHENTIC MATERIALS; APPENDICES, CHARTS AND TABLES;

Teaching/Learning Strategies

(Applied to Problem Solving)

Strategies	Student Groupings
Brainstorming (the written form) Collaborative/Co-operative Learning Direct Teaching	Individual work of students Work in small groups /in large groups The whole class works together

Peer Assessment Sheet

Peer Assessor:

For each student in your group, please circle the appropriate number in each of the columns.

1 = fair
2 = satisfactory
3 = good
4 = excellent

Student's Name	Co-operation	Developed Efforts	Oral Communication/ Presentation	Written Work
	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4

SWOT Analysis

(Examples of Questions for an individual or group; used before and after a task)

Strengths	What are/were my/our advantages? What do/did I/we do well?
Weaknesses	What could be improved? What should be avoided? What was not done well?
Opportunities	What are some of the things, conditions, times that are in my/our favour?
Threats	What obstacles or barriers do/did I/we face? Is anything changing around me/us that should cause me/us to work differently?

The Energy Production at Ústi Region SWOT Analysis

(As a Source of Material for Problem-Solving Tasks
- the Area of Electricity Power Stations and Its Development)

Strong and Weak Points

Topic No. 1

Sources and Products of Tourism	
Strong Points	**Weak /Points**
Location of the Region in the Trans-European Corridor	Vast Damage of Landscape and the Environment

Energy Potential of the Region – Great Number of Power Stations	Needs of re- mooving of objects (church, castle , villages etc.)
Number of Coal Mines Places	Local problems
Numerous Industry Centres (Bílina,Most,Chomutov)	Lower member of ended recultivation
Possibility of Making Use of Some Weaker Points of the Region for the Development of Industry (Industrial Tradition, Landscape Damage)	Lack of Additional Services

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