

The Analysis around Strategies How to Engage Generation Y Learners

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Abstract The main issue of this study is the analysis around strategies how to engage generation Y learners. The aim of the study was to find out the contribution of various teaching and learning methods that teachers and learners can use in the twenty-first-century classroom. This study is a continuation of the previous research provided in 2010. During the study various methods were used: problem based learning, project based learning, team work, inquiry based learning, interdisciplinary approach, experiments – from very simple and low cost experiments to computer based experiments and remote laboratories. It was found out that generation Y learners can be motivated by various instructional methods based on their own activity. Their own doing seemed to be more important for them than learning itself. It is then more than useful to use educational materials including charts, graphic presentations and cartoons. The main goal of the study was to analyze the effectiveness of the use of mind maps and concept maps, which are not common during students' instruction at secondary and high schools in the Czech Republic. A set of concept maps on the basis of high school physics textbooks was prepared.

Keywords: *generation Y, motivation, concept maps, activating methods*

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1. Introduction

Much has been written about changing the way of teaching in our schools in the beginning of the 21st century. Students, the so called Y generation, have different priorities and different ways of thinking and learning. The basis for successful work of the practicing teacher is to motivate students. There are many teachers who have deep expertise and yet fail to arouse interest in the subject. Nowadays students are surrounded by modern technology, and the aim of the investigation was to determine what methods should be used to motivate these students. It is not just about computer technology, whether it be computers or tablets, but also about other common household equipment such as microwave ovens, TVs, smartphones, smart home devices, etc.

As published earlier [5] innovative teaching methods were analyzed and tested. There are various guidelines and procedures how to motivate students. For example, Mees [8] lists 21 simple suggestions. Of these the following suggestions can be chosen: to create an environment without threats and stress; accurately define goals; allow self-control and responsibility for students' learning outcomes; try to change the environment; give examples from practice; and introduce work in groups. It is necessary to point out the importance of giving an appropriate example by our own conduct - not underestimate showing enthusiasm, getting to know our

students, giving them the opportunity to succeed and, last but not least, by showing a sense of humor.

In teaching generation Y, learner centered methods should prevail. That means that we should develop communication and presentation skills, self-implementation, the ability to discuss, create arguments, defend their own opinion and find a compromise. Furthermore, as the literature states, these methods support social skills, analytical and critical thinking, creativity, art talks and empathy in certain roles. Through activation methods, students can also learn to be independent in their actions, thinking and responsibilities. This is all in addition to the expertise and knowledge equally important in both their professional and personal lives [7].

2. Learner - Centered Methods

Summary of learner - centered methods that have been used in our research.

2.1. Problem Based Teaching

It can be said that problem teaching is considered to be the basis of activation methods. Problem situations can be variously conceived, handled and processed. Problem situation has to be induced by the teacher – it is based on a "nuisance" conflict (contradiction) that appears during instruction or is based on life experiences of students. To

successfully resolve the problem, an active work of students who want to solve the conflict is necessary. There is a number of skills acquired during problem teaching, especially creative thinking, forming hypotheses, developing sensory perception, learning generalized concepts, principles and relations between concepts, communication, mental operations (analysis, synthesis, comparison ...) and creativity. Problem teaching has several stages that should be properly thought out and prepared by the teacher. Those stages are: 1. Creation of a problem situation (can be created by students as well induced spontaneously), 2. Its analysis (students become familiar with the assignment, find out what knowledge of the issues have already been acquired and can be used to solve the problem, and discuss which elements are unknown), 3. Formulation of the problem, mostly as a conclusion of the discussion from Section 2; the formulation ends mostly with the formulation of questions, 4. Problem solving, in which students use a variety of methods, from an intuitive approach through trial-and-error to rational analysis, 5. Verification of the solution, in which we prove the correctness of the solution. 6. Generalization of the solution, which is mostly instructed by the teacher (in collaboration with the students).

2.2. Project Based Teaching

It is a comprehensive teaching method that is presented in today's school, particularly by the implementation of interdisciplinary relationship required by the Framework Educational Programs. It requires active student work and very often group work as well. Project-based teaching is also an instrument suitable to stimulate cooperation between teachers of different subjects who can then form a team for the preparation of the project. It can be said that all projects involve cross-curriculum links with ICT as a subject, since the preparation of projects, their solutions and presentations are now impossible without the use of modern information technology. In addition, projects might promote not only cooperation between students of one school but also between students of different schools. They can also support international projects preparation and solution.

Projects can be sorted according to various criteria (duration, age, subjects, etc.). In our schools, especially primary ones, short-term projects outweigh other projects. Schools organize the so-called Project Days, devoted to a certain problem which students explore from the perspective of different subjects (http://www.gymji.cz/data/soubory/171_den_zeme.pdf).

Trainee physics teachers are getting acquainted with project learning and with creating projects within the curriculum of Didactics of Physics and the subject Physics-Technique-Nature. In the framework of the project Modules, the following projects were developed in detail: Milk and Dairy Products; Explore your Surroundings; Noise. The project proposal accepted interdisciplinary links; part of the material is a theoretical study text, suggestions for students' practical work and sample solutions of laboratory tasks. The project has been prepared, so that it can be used in the classroom without the teacher having to make additional adjustments.

Project based teaching is very popular at schools. The work on projects was evaluated positively by both

teachers and students. If the project is adequately prepared, teachers will readily include it into teaching. On the other hand, it was found out that in some schools students were overwhelmed with projects. The problem is that some teachers solve the lack of direct teaching time by using projects. As a result, some topics are delivered to students by students; therefore, the project becomes the "only" way of meeting the requirements for the implementation of cross-cutting themes of the Educational Programme - and interdisciplinary links. Simple ideas for projects were also included in new physics textbooks for secondary schools published by the publishing house Prodos. The list of project incorporates for example the topics: Water, Why are penguins fat, How to build a trebuchet, Make your own ice-cream, Oil in our live, How to build a weather station etc.

2.3. Concept Mapping

The explanation of the Concept Mapping theory is presented by Novak [9,10], Safayeni [13] and others [1,12,14]. The basics can be found in the learning theory by Ausubel [2]. The influence of learners' preconcepts is crucial. And the prior knowledge (preconcepts so as misconcepts) can be represented through a visual language very close to the expectations of the generation Y learners. It is necessary to distinguish between mind maps and concept maps. The mind map records information, ideas, knowledge which we have on the topic. Concept maps, on the other hand, contain connecting words that express relationships between concepts. Today we can create both mind maps and concept maps by using simple tools available on the Internet. As far as mind map creation is concerned, the user's top-ranked programs are Google it and Free Mind. In the classroom a mind map can help teachers to get a notion of the knowledge and information students associate with that particular concept. Our goal was to use and create concept maps that represent the organization of our knowledge, as well as the structure of concepts and the relationships between them. In teaching physics, the concept map has importance not only when discussing a new curriculum, but also as feedback on student's understanding of a given subject matter. Students' concept maps are different, even though they have been created by the same key concept. Everyone has a different conceptual framework and a different pre-competence. However, in the context of concept maps used in teaching of physics, maps should always include the basic concepts of the topic, and their hierarchical structure and indications of links between concepts.

In teaching concept maps are included mostly at the beginning of the topic (finding pre-competence) and then at the end of instruction (to determine how students included new concepts into existing conceptual structures). When creating a concept map, a student must carefully think through the individual links between concepts and concept content. For the purpose of using concept maps in teaching the methodology of concept, map entering and method of assessment (quantification of students' results) have been developed. We can also use appropriate software tools. In our case we worked with the program CMAP Tools; there are other programs available such as Graptolite, VUE, Cacao and many others. Concept

mapping is the right strategy that follows the needs of an active learning environment.

3. The Purpose of the Study

Research on the suitability of activation methods usage in teaching took place at four secondary schools. Methodological sheets with instructions and recommended activity methods were prepared for teachers. They specified tools needed for experiments, sequence of activities, time period needed and ways of inclusion of the presented topic into teaching. A shortened version of one of these materials you can find in the appendix of this paper. Schools also had the opportunity to use the projects prepared in the context of the project Modules as an innovational tool in the framework of integration teaching of modern physics and chemistry (No. CZ.1.07/2.2.00/28.0182). In this paper two main questions of the study were worked out, questions regarded concept maps.

Research questions of the study can be summarized as follow:

- A. What is the most suitable version of concept mapping creation?
- B. How to evaluate the students' concept map?

4. Methods of the Study - Instruments and Procedures

The research around activation methods was provided at 4 high schools in Moravia. In physics classrooms students were asked to complete the worksheets. The number of respondents was 136, 87 girls and 49 boys. Students received worksheets with tasks (problem questions, experiments, numerical task, concept maps). All lessons were evaluated using interviews with teachers and students. Criteria of activation methods evaluation included preparation for teaching, students' activity in the classroom and difficulty of the teaching method for students.

The second part of the research regarded concept mapping. The research took place at one high school (two classes 29 and 26 learners) and in the framework of two seminars for pre-service and in-service physics teachers (13 participants). All students were asked to construct a mind map according the main concept Heat. After instruction – high school students were taught the topic Heat and temperature during six Physics lessons, the activity was repeated. After they had become familiar with mind maps, the construction of concept maps was required.

There is no such thing as the right or wrong concept map, because each one is individual and must be evaluated using predetermined criteria. Generally, qualitative evaluation of concept maps is given preference. In this case the teacher assesses the following:

- 1. Are the most important concepts shown (identified)?
- 2. Are the relations between concepts scientifically acceptable?
- 3. Is the substantial number of branching levels of the hierarchy and cross links represented?
- 4. Does some statement indicate that a student has significant misconceptions?

5. What changes have occurred in the student's map over days and weeks?

It is also possible to evaluate the complexity of the map.

In our design and evaluation of concept maps we restrict testing to only single bonds between concepts.

5. Results and Discussion

5.1. Research Question A

An example of two mind maps created by university students before instruction are shown in Figure 1. A mind map created after discussion is presented in Figure 2. The progress in knowledge can be easily identified.

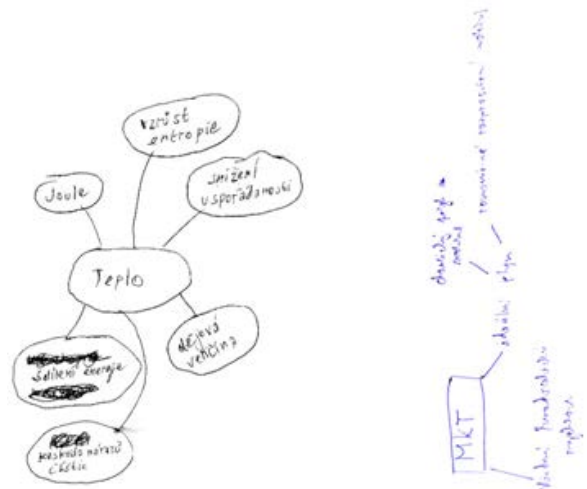


Figure 1. Mind Maps created by high school students before instruction

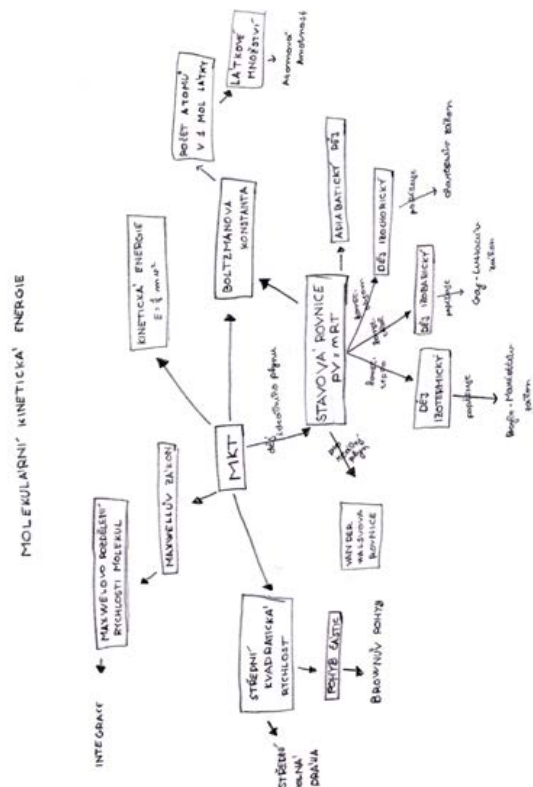


Figure 2. Mind Map after instruction (the same topic)

The methodology of entering concept maps was chosen in three ways: 1. Students were provided a blank draft of a

published by the publishing house Prometheus, which are used in high schools in the Czech Republic.

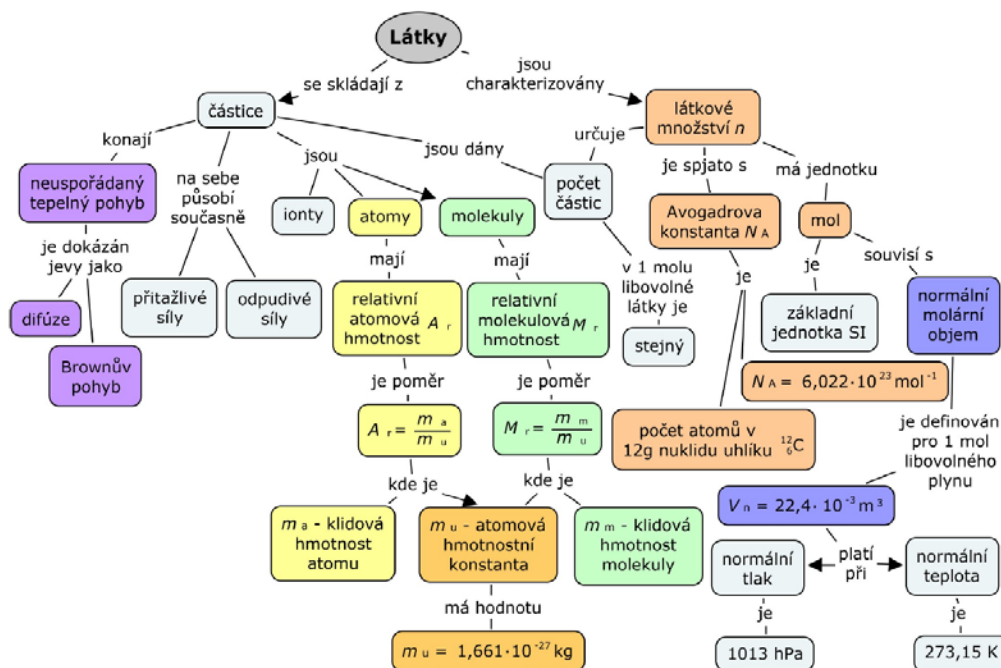


Figure 4. Concept map prepared by the teacher in CAMP Tools software

The evaluation of experimental activities (heuristic method) showed that they challenge the creativity of teachers and make students very active so that are able to provide a range of tools themselves and to come up with different ideas. In terms of difficulty the heuristic method seems to be a moderate activity for students. Inclusion of this method into teaching is time - consuming.

Concept maps provide a positive impact of meaningful learning. Concept maps can be used as an evaluation tool for assessing students' understanding in physics. Concept maps give an immediate feedback to the learner so as to the teacher. Further progress of this teaching aid will be supported by the use of ICT technologies – CMAPTools on iPads. ICT application meet with a positive response from the Y generation learners (<http://cmap.ihmc.us/cmaptools-for-ipad/>).

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Appendix

Activity - Flow of fluids

Tools: Zone, stopwatch, string, gauges, load - stone, worksheet, Internet access

Safety: Risk of falling into the river, in the case of slippery bottom fording, need of protective equipment (high boots)

Outputs: Students can distinguish between laminar and turbulent flow. Students can calculate the volumetric flow rate. Students prepare and carry out field measurement -

measurement of the flow of the river at the place of residence. Students work with the Internet and other study literature - seek and process information about the turbulent flow, swimming animals and hydrology.

Initial activity

Motivation - students discuss from historical and contemporary perspective the importance of water course. Think over flooding in the past and at present. Explains how human activity affects nature.

Main activity

Students revise work with graphs, representation of vectors, calculate ratios. Become familiar with the concepts of volume flow, laminar and turbulent flow. After studying the theory students prepare and carry on laboratory tasks.

Final activity

Students discuss the results of their measurements.

Additional activity - students prepare a presentation on the topic: a), swimming of animals, b) turbulent flow - Karman vortex path, c) hydrology - information important for the residents.

Motivation

Interdisciplinary relationships - history, mathematics, geography (hydrology), physics

In the past human settlements always emerged near water courses. Water was a source of drinking and utility water, food, transport artery, formed part of the defense system of settlements. People have learned to live near rivers, if there was a flood, they were able to protect themselves. In our country in the early 20th century people started an extensive regulation of water flows as protection against flooding. Concurrently the construction of both residential and industrial buildings in close proximity to rivers (in floodplains) was expanded. Perhaps people have lost their "historical memory". It was proved by the floods that hit Moravia in 1997 and Bohemia in 2002

http://cs.wikipedia.org/wiki/Seznam_povodn%C3%AD_v_%C4%8Desk%C3%BDch_zem%C3%ADch

Measurement of flow velocity and mass water flow rate.

Fluid flow arises due to the pressure difference. Streamlines are lines that depict the trajectory of flowing fluid particles. Direction of particle velocity is determined by the tangent to the streamline at that point. The flow can be a) laminar (streamlines are parallel), b) turbulent (create a vortex).

Steady floating of an ideal fluid – through each section of the tube passes at the same time the same volume of fluid. We introduce a variable volumetric flow rate: $Q_V = V/t$. The following applies: $s = vt$ (path traveled by the particle in time t), the volume of liquid can be expressed using the cross-sectional area S as $V = sv t$. After substituting we get the formula for the volume flow in the form $Q = Sv$. Volumetric flow rate is measured in units of $m^2 \cdot m \cdot s^{-1} = m^3 \cdot s^{-1}$. Based on the assumption of steady flow a continuity equation is applied $S_1 v_1 = S_2 v_2$. "In a flux of fluids it comes to small objects entrainment, such as grain of sand or gravel, in the river bed. Entrainment law is called Air's law and says that the n -times faster stream is able to entrain n^6 - times heavier items. Although this law sounds strange, we will show it's veracity on the example of three rivers, the velocity of which is in the ratio 1: 2: 4. According to the law the ratio of stones weights drifted by currents of the rivers is 1: 64: 4096, that means that a calm river that carries barely a grain of sand weighing 0.25 g, twice faster river can drift gravel weighing 16 g and two times more faster than that mountain stream is able to entrain stones weighing 1 kg." (quoted: http://www.techmania.com/Eduorium/art_exponaty.php?xkat=physics&xser4d656368616e696b61h=&key=281)

Water flow in the river

The flow velocity in the river is determined by the drop in the river bed and water depth. In the bed of the river the flow velocity changes, at the surface, banks and bottoms it is slower due to the friction impact. The fastest velocity we can measure in the flow path at a certain depth below the surface. The flow velocity of the water can easily be measured by using the *float method* (cork, ball), when we measure the time during which the float travels a certain distance.

Flow velocity

To measure the flow velocity of liquids and gases we can use the Venturi tube. It looks like a part of the tube, which is narrowed down in a certain place and this place is connected to a differential pressure gauge. Using this gauge we can measure the difference in pressure in the main pipe and the tubing.

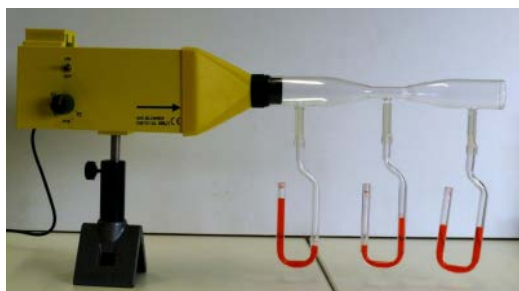


Figure A1. Measurement using the Venturi tube

The flow is expressed by the volume of water that flows through the flow profile per unit time (m^3 / s) Calculation of the average mass water flow rate velocity " v " is

performed by vertical perpendiculars on the tape (rope) that is stretched between the two sides and divided into equal segments (e.g. 0.5 m). The own flow area is divided into a number of sub-tabs with a certain value of flow rate. The resulting value is an average one obtained from the further measured values. For the calculation we use elementary mathematics - the formula for the rectangle. In case a current-meter is not available we measure only the surface velocity of the water flow.

Laboratory work - measuring mass water flow rate in the river

Tools: rope, string, tape, weight, PET bottle, stopwatch

Progress of work:

1. Measure by rope the width of the stream (a small river ford on the other side and measure the distance between the banks, in case of a big river measure from the bridge).
2. Between the two banks (on the bridge), stretch a tape. On the tape mark the sections at 1 m distance (regarding the width of the river 0.5 - 1 m).
3. On the shore you measure out the distance from the bridge - the segments on which we'll measure the speed of the current.
4. Prepare a half-empty PET bottle and tie it on a string. The string will be used to pull the bottle out of the river and repeat the measurement.
5. In the taped sections throw the bottle into the river and measure the time for which the bottle will travel a path laid out along the river bank. Record the measurement results into the prepared table.
6. Calculate the speed of the current.
7. In the taped section of the bridge measure by the weight attached to a string the depth of the river. Roughly determine the profile of the river bed.
8. Calculate the volumetric flow of the river - multiply the surface profile by the velocity of the river current.
9. Compare the data obtained from the calculation with the information data on the basin website the river (in case of Morava river <http://www.pmo.cz> (VH dispatching - Stocks and flows)).

Discussion:

1. What is the current state of the water flow rate (dry, normal, high flow)?
2. When a level of a flood activity is announced at the river?
3. How does a flood rise?

Enhance curriculum - cross-discipline links

1. Explain the principle of measuring blood pressure with tonometer
2. The flux of liquid around the moving objects in the liquid - swimming fish, human being
3. Karman vortex path
4. Hydrology - Information on the hydrological situation.

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