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ICT ON FOUR LEVELS OF INQUIRY-BASED SCIENCE EDUCATION IN ENVIRONMENTAL EDUCATION

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Abstract

Inquiry in the natural sciences is an often used term. Inquiry-Based Science Education with the support of sophisticated ICT lacking. Inquiry-Based Science Education has clearly defined its four levels, in particular the use of teaching depends on the particular pupils and teachers. This learning strategy can thus rendering the various options and the use of ICT available at the school. The following article's focus is on a selection of specific technologies available and used at a primary school in connection with the different levels of Inquiry-Based Science Education and the extent of its involvement. The paper also describes social elaborated topic of environmental education in the sample worksheet for elementary school pupils.

Keywords

ICT, Inquiry-Based Science Education, four levels of Inquiry-Based Science Education, activities with ICT, environmental education, computer supported experiment

A view on tendencies in contemporary education

Contemporary teaching documents for elementary schools are based on educational processes, fundaments of which lie in planning, organizing, conducting the learning process in such a way that knowledge, skills and attitude obtention comes through active participation. It is important to create optimal conditions for developing pupil's creativity.

Educational tendencies are based on an idea that a pupil should not acquire information passively but the acquisition should be based on his/her experience, knowledge and skills. An

important part of this concept is a special consideration of pupil's needs – acceptation of his/her world, findings, ideas, feelings, interests, personal pace and evolutional rhythm (Stuchlíková, 2010).

Pupil's competences develop during classes based on examples and situations from everyday life. This way learning gains personal sense. Examples and model life situations gives pupils the opportunity to perceive learning as an existentially important activity necessary for his/her personal life as well for surrounding world. Along with the learning process the pupil is lead towards self-control, self-examination and responsibility for his/her own decisions. They learn to work individually and cooperate in team.

Inquiry-Based Science Education applied on cross-sectional environmental education enables wide range of opportunities to connect ICT with this teaching strategy. This article points out possibilities of connecting ICT, four levels of Inquiry-Based Science Education and the environmental education. Pupils involved in pedagogical processes in grammar schools use information and communication technologies when learning natural sciences in different ways, depending on many factors. The level of exploitation depends on actual topics, hourly donation, teacher's and pupil's attitude towards technologies, and on an interest in refreshing the classes with something new and fresh.

Defining ICT literacy

ICT literacy is a collection of skills an individual needs necessary to decide when or where to use available ICT and effectively use them in order to solve different situations during the study or in everyday life in changing world. According to a collective work at VÚP in Prague - Literacy in education handbook ICT includes the following factors (Altmanová, 2010): At first practical skills and knowledge that enable an individual to use particular ICT effectively and with intelligence; the ability to complete, analyze, critically evaluate and use information with support of ICT; last but not least the ability to use ICT in different contexts and for different aims based on understanding the terms, concepts, systems and operations in field of ICT; knowledge, skills, abilities, attitudes and values leading to responsible and safe use of ICT; and also abilities to receive new stimuli in ICT field at the same time giving critical judgment, understanding fast development of technologies and its importance in personal evolution and the influence on society.

ICT Literacy in Education manual also states– a quite obvious fact – that today's condition of FEP ED enables the evolution of ICT literacy however does not support it consequentially. As the ICT usage develops in individual fields of human activities, it can be implicitly traced in key competences, characteristics and final aims of educational sphere and many other expected outputs of all educational fields as well as in cross-sectional topics in FEP ED. The field of ICT is in fact so complicated that in reality we cannot count on teachers to sensitize this to a necessary extend and make them put enough emphasis to reach methodological, systematic and steady evolution of all components of student's ICT literacy. ICT are stated exclusively in key competences (Altmanová, 2010). *Learning competences* – the pupil searches and sorts out information and based on understanding, connection and systematization uses them effectively

in learning process, creative activities and practical life. *Communicative competences* – the pupil understands different types of texts and records, picture materials, commonly used gestures, sounds and other information and communicative means. He/she analyses them, reacts to them and uses them creatively for the purpose of self-evolution. For the purpose of implementation into social life, uses information and communication means and technologies for high quality and effective communication with the surrounding world. The ICT are also mentioned in characteristics of such educational fields as *Language and language communication, Mathematics and its application, Information and communicative technologies, A Human and nature, Human and health, Human and the world of work.* Furthermore in expected output they can be found most often in study materials, but only in some educational fields or cross-sectional topics as *Personal and social education, Educating a democratic citizen, Education towards thinking in European and global context, Multicultural, Environmental and Media education*. There is wide range of individual tools and topics offered, sometimes focusing unilaterally.

Inquiry-Based Science Education in biological education

In the scope of biological education on grammar schools apart from classical teaching methods new ones should be applied; such as: activating and complex teaching methods preferring construction, discussion and cooperation from transmission and competition of individuals (Rosecká, 2006).

According to Bílek to obtain effective biological education, preference of educational methods based basically on self-examination, measures, experiment and evaluation of real actions, objects and states, on visualization and modeling, on active search and processing the data by the pupil is essential. Many different ICT technologies can be asserted here. Biological education enables pupils very well to apply a whole scale of various methods, respecting distinct characteristics of individual pupils. An outstanding element in teaching individualization are so called constructivist methods of „conducting" learning activities, which have been so far perceived as alternative teaching methods. A teacher becomes a „manager", mentor and helper. Pupils become active subjects of teaching by searching, obtaining, categorizing, rating, judging and processing information. Pupils discuss their findings with classmates and the teacher, refine their opinions, rectify their attitudes, or they can try to create their own „theories". Intellectual operations on various levels are induced with appropriate support and suited to individual characteristics. Their original concepts or individual experiences are confronted with facts brought via above mentioned sources of findings (Bílek, 2008).

A possible didactic means of educational innovation in biological subjects connected with environmental education is an Inquiry-Based Education (IBE) or Inquiry-Based Science Education (IBSE).

The meaning of the term „inquiry" apart from its basic meaning, includes also search for the truth and can be also qualified as target oriented process leading the pupil to gain the capacity to define the problem, comment it critically, find alternative solutions to the problem, to plan

the research, to conclude and deduct and to create model of investigated process. Application of IBE in biological education should be conducted in such a way that would awake in pupil the need to „to puzzle things out. Pupils are supposed to find out that research is the essence of biological sciences (Stuchlíková, 2008).

Concerning the external conduct of pupil's „research" differentiate four levels. Based on teacher's consideration, pupils can so work in Inquiry-Based Science Education of following four levels (Eastwell, 2009).

Confirmation research – students are provided with the question and action (method), results are known in advance, the purpose is to confirm a principle through own experience.

Structured research – the teacher presents question and possible action (method), based on their knowledge students determine the explanation of studied phenomenon.

Guided research – the teacher presents a research question but leaves the method and solution open to students.

Open research – students present a question, think of method, realize the research and define the results.

Four levels of Inquiry-Based Education give the teacher the opportunity to choose the most a form, which is the most suitable for particular moment for given group of pupils and topic. Learning in form of individual discovery represents a uniquely important method of knowledge acquisition. But to be successful in school conditions it is necessary to equip pupils with preliminary information and skills so that the intended goal is clear and adjusted to their capacity (Maňák, 2008).

Environmental education with use of Inquiry-Based Science Education with ICT support in worksheet draft

Environmental education as a cross-cutting theme produces educational space enabling employing practical research procedures. The goal is to enable pupils to understand given problem through their own research. To obtain the intended goal, worksheets as a didactical means for IBE were created. It is teacher's responsibility to follow the study materials and conduct the classes in a comprehensible manner.

Electronic worksheets for pupils contain experiments that are thematic outcome of environmental education cross-cutting theme and are a possible use of Inquiry-Based Education with ICT support.

Pupils verify their knowledge here or try to understand given issues which enables them a more knowledgeable perception. The experiments are long distance and it is up to the teachers or pupils how they deal with the schedule. Questions for reflection are part of the experiment followed by students' slideshow demonstrating their results and conclusions. When creating these materials pupils have to make use of gained knowledge. By presenting it as something they found out themselves they repeat and internalize it at the same time.

There is a pile of worksheets for pupils prepared in electronic version. Pupils can keep them or print just the necessary parts for the purpose of making notes if necessary. Pupils follow the worksheet and perform particular assessments focusing on understanding given issue. They try to discover the principles of the phenomena that they actually encounter every day. Worksheets are focusing on Inquiry-Based Education supported by simple experiments which pupils will execute individually or in groups. Special attention is given to the individual pace of pupil and to giving them a chance to ask questions whenever anything incomprehensible occurs. Also discussion among participants of educational process is important to enhance Inquiry-Based Education.

The reason of choosing water and air is that these are the substances which pupils commonly encounter but often they are not aware of the substances' importance on Planet Earth. Themes for particular worksheets Water and Air – basic life conditions:

- water and water pollution;
- drinking water;
- water circulation and its distribution in hydrosphere;
- particular characteristics of water;
- global warming and greenhouse effect.

Example of worksheet structure

1. Work with text

Pupils are given a short text (abstracts) derived from different sources, which they have to carefully read and understand. There are three simple questions or sentences following. Pupils have to give response to them. They don’t need any other particular source, the text contains all necessary information. It serves to introduce the issue or to evoke discussion among participants of educational process. Pupils should ask the teacher about issues that are not clear.

2. Work with information (internet)

Pupils answer and think about the questions, they use the internet and electronic sources (educational program on CD etc.) for support. Questions are related to the given topic and it is up to the pupils to answer as precisely as possible, or to support their answers. This motivates them towards critical thinking where they have to comprehend the text, its context and differentiate between significant and inessential information. The level of pupils' exactness gives the teacher the insight into the pupil’s comprehension of the essence of the outlined article.

3. Experiment

Experiment is the most important as well as the most laborious part of the worksheet, where pupils by means of their own simple experiment confirm their knowledge, or understand given issue and get a more comprehensive stand. Many experiments are long distanced and it depends

on teacher and students how they will deal with the time schedule. International biological research PISA inspired me during the preparation of the experiments, as well as tasks given during the biological Olympiad and environmental association Pasco and examples from Integrated biology in experiments publication. „Food for thought" questions are a part of the experiment followed by students' slideshow demonstrating their results and conclusions. When creating these materials pupils have to make use of gained knowledge and by presenting it as something they found out themselves, they repeat and internalize it at the same time. According to teacher's consideration pupils can work on the following four levels: Confirmatory research – questions and method is provided, results are given, own practice is to confirm the above mentioned. Pupils know the results of the experiment, because the teacher will provide it in advance. Structured research – teacher provides the question and potential method, pupils form the explanation of examined phenomenon based on already acquired knowledge. Directed research – teacher gives a question, students create method and then conduct the experiment. Open ended research – students ask questions based on the curriculum, think of the procedure, execute their own research and form results.

Some experiments are designed as computer supported, so that pupils have the possibility to use sensors and software designed for this kind of experiments. Measuring system eduLab is applicable, but also other systems are available at school.

The results of the experiment should be demonstrated via power-point presentation created on the computer. It is also possible to share the results at the on-line blog, or social network. Especially successful experiments, described or published can be inserted by the teacher as DUMs – digital educational materials and published on portals dealing with education.

4. Pupils' activities (questions for reflection)

Last part of the worksheet is to intensify the gained information and it depends on pupils whether they use help from different validated sources or answer these questions based on acquired knowledge in their own words. In some cases pupils are asked to prepare the power-point presentation for other pupils or to attach photos from particular experiments and exercises to the worksheet. All tasks and questions are part of so called additional curriculum, where pupils should show their ability to contemplate over the issue and sensitize connections between subjects. All school information and communication technologies are available. It is up to pupils which they want to choose (Přinosilová, 2012).

Following methods and forms of work with ICT are used in solving problematic jobs (Kubicová, 2011):

- computer aided experiment - remote experiment, virtual experiment;
- work with sensors and suitable software to execute the experiment;
- pupils preparing a presentations of the experiment results;
- sharing experiment results with other pupils on social networks and various blogs;
- students and teachers prepare presentations on certain topic;

- pupils and teachers prepare materials for interactive board;
- searching for information and working with information;
- publishing various materials on portals concerning teaching.

Example of worksheet for Inquiry-Based teaching in environmental education with ICT support on Greenhouse effect theme

Greenhouse effect

Presentation of a part of a worksheet, that was prepared for Environmental education, with ICT support (Mechlová, 2012).

Work with the text

„Long term measurements proved that within 140 years, the average temperature of the Earth surface increased by 0.8°C. Results of the research executed on drills in iceberg proved that the period between 1950 and now was the warmest period since 6000 years. The higher frequency of extreme climatic events has also been registered. It is expected that the level of the sea will rise which can lead – apart from unimaginable impact - to numerous social problems“. (Matějíček, 2007)

Questions related to the text:

1. How much has the temperature of the Earth surface increased, during last 140 years?
2. What research led to the conclusion that we live in the warmest period since 6000 years?
3. What is the most probable cause of the numerous social problems?
4. What does the term climatic event mean? (use all available sources to look for the answer and make a draft of examples of some climatic events)

Information search – internet, educational programmes

Enormous problem that causes global warming are greenhouse gases. A higher concentration of these gases in the atmosphere leads to intensifying of the greenhouse effect. (Matějček, 2007)

Work with the obtained information

1. Assignment.
2. Describe how the greenhouse works.
3. What materials are used to build the greenhouse and what are their features?
4. What would happen, if you placed a whole planet Earth in a greenhouse?
5. Search for gases that we call greenhouse gases. Draw its molecules!

6. In your own words describe the picture – polluted air, which your classmate found over the internet. What does it depict?
7. Using chemical formulas match the descriptions of the gases with the arrows on the picture. What do these molecules have in common?

Computer supported experiment

Execute a simple experiment!

Tools: 2 jars, caps, plastic bottle, sticky label, scissors, string, thermometer (thermo sensor), PC and the software for sodium hydrogen carbonate (soda), vinegar, balloon, straw.

Work flow:

1. Prepare a glass filled with „air“ (no. 1) and close the lid. Make a hole in the lid and seal it with the sticky label.
2. In the second jar, make a hole for putting a straw in it.
3. Put soda into the plastic bottle and pour as much as necessary vinegar inside. Quickly put a balloon on the bottle and wait until it fills with the gas. Bind the balloon with the string.
4. Slowly insert a straw into the balloon and then insert the straw into the jar. After the gas moves from the balloon to the jar, seal the hole with the sticky label.
5. Leave both jars in the sun for a whole day. Check the temperature of the gas inside the both jars and put them down into the results.
6. Write the chemical formula for emergence of the gas in the balloon.
7. Write what gases does the „air“ consists of in the jar no. 1.

Student´s activities – questions + exercises to think over

Questions:

1. What life on Earth would be like if greenhouse effect did not exist?
2. How do people influence the warming of the planet Earth?
3. Give suggestions to slow down the warming of the planet Earth. Can you influence it?
4. Who is the climate-sceptic? What are his opinions about the warming?

Elaborating exercises + individual presentation of the results – processing the results of the computer aided experiment, publishing the results, etc.

Question for headpieces:

1. What is the difference between the way the greenhouse works and the greenhouse effect?

Work sheets for Inquiry Based Education with ICT support on the theme of the greenhouse effect and results from practice.

Before the actual testing with the work sheets, 59 students were given a pre-test which contained questions on the theme of the greenhouse effect and other questions concerning the basic conditions for life. It was discovered that this group of students have the biggest problems with knowledge and inquiry based questions, where the largest number of blank answers or completely wrong answers were recorded. As far as inquiry based tasks are concerned, only two pupils answered at least one question with the maximum number of points. In other cases the answers were basically correct but often with mistakes or not thought through. Knowledge questions were, as far as exact replies go, a bit better, but even so the number of these correct answers was not at all significant. On hypothetical questions, the students always managed to answer in some way, even though many of their replies were literally the first thoughts which came to their minds.

In the case of other pre-tests used for verifying, where the difficulty of the individual questions was primarily evaluated, interesting results were discovered. From the viewpoint of the greenhouse effect, students have the biggest problems with questions 2, 17, 19, 20, 22, and 23, which are prevailingly from the inquiry-based group. These questions also have a high Q difficulty valuation. On the other hand question 3 appears as very easy while having a low Q difficulty valuation.

Test for students

(questions on the topic: the greenhouse effect)

Pre-test/Post-test – environmental education Name:

Answer these questions!

2. What is the name of the natural phenomena which contributes to maintaining a suitable temperature for life on the planet Earth and prevents the escape of warmth to outer space? (3b)
3. Try to think up a simple experiment by which you could prove this phenomenon! (3b)
4. What would happen to a hamster which was placed in a greenhouse in the summer? (3b)
5. Which atoms is a molecule of carbon-dioxide composed of? (3b)
6. What is the simplest way to get carbon dioxide as a gas? (3b)
7. How would planet earth look if the amount of carbon-dioxide was 70% (now it is 0.034%)? (3b)
8. What gases are called greenhouse gases? (3b)
9. Bred cattle produce a large amount of greenhouse gases. Suggest a way to limit this production, or at least moderate it! (3b)

10. CO_2 is a greenhouse gas and N_2 isn't. Try to write a rule which determines which gases are greenhouse gases. (3b)
11. Explain the process of global warming (3b)
12. Suggest an experiment which would prove that global warming is really occurring (3b)
13. In the past Greenland was settled, what will happen if the planet continues to warm? (3b)

A primary school in Ostrava participated in the testing using the work sheets on the topic of the greenhouse effect and the basic conditions for life. The participants were 9th grade students, who were attending a natural history course. The subsidized course amounted to 2 hours per week. The instruction took place in blocks. The number of students in the class was 15.

The students predominantly worked alone and with the assistance of the teachers on the work sheet tasks. According to need, the students were either in the natural history classroom, the computer classroom or in the multimedia classroom (with the interactive board). The students had all the technology which is used at the school available, including modern technology suggested by the students themselves and approved by the teachers, as well as sensors for computer supported experiments. The students used various forms of technology during the whole course of working with the work sheets. Discussion on the experiments carried out was guided by the teachers which tried to encourage the students' further interest in this field. Some tasks were carried out by the students as homework. The students gradually went through all tasks and completed them. Emphasis was placed on an individual work tempo. The students were also given a pre-test and a post-test containing questions which were divided into three groups: Knowledge based questions, inquiry based questions and hypothetical questions. The number of questions related to the „greenhouse effect" was 12. Other questions (knowledge based: question numbers 1, 16, 19, 22), (inquiry based questions 2, 17, 20, 23), (hypothetical: question numbers 3, 18, 21, 24). Awarding of points for questions: 0 – no answer or wrong answer, 1 – some indication of or an answer at least a bit connected, 2 – answer which is basically right but is either mistaken or incomplete, 3 – correct answer, extensive, innovative, without mistake. Overall the students could reach a maximum of 36 points (see Fig. 1).

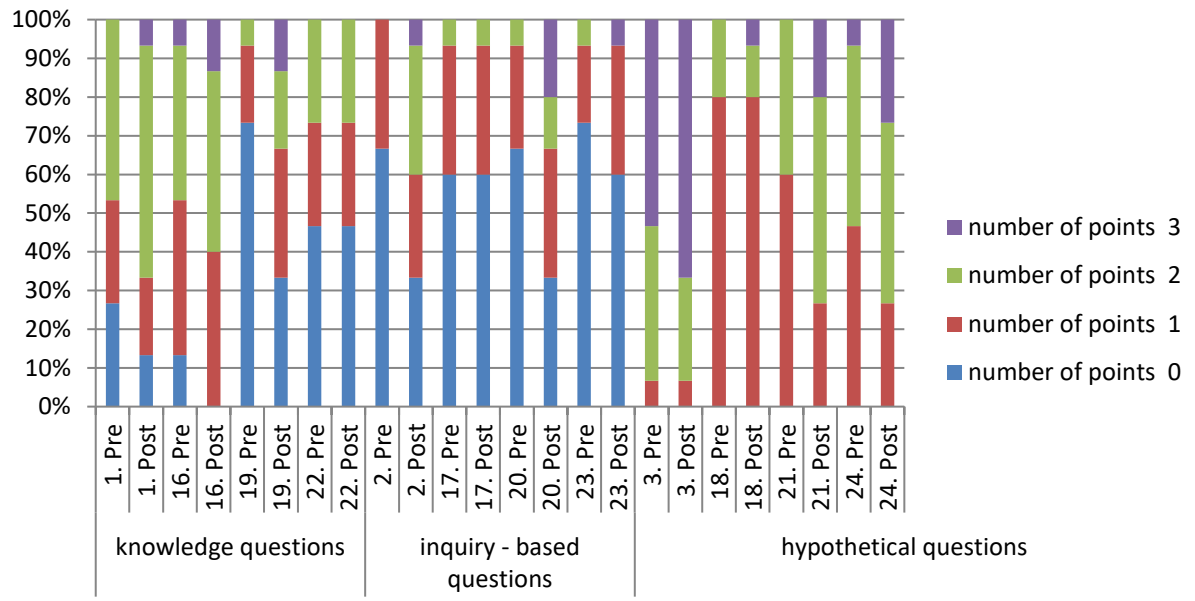

Fig 1: A comparison of the pre and post-test results of students who graduated the IBE education with ICT support on the topic of the greenhouse effect.

A comparison of the results of the pre and post-tests achieved positive results. The students managed to gain a better point score after completing the Inquiry-Based education with the support of all available technology at the school. The exceptions were questions 22 (knowledge based question) and 17 (inquiry-based question), which are questions with a high Q difficulty valuation. Other questions from this group of difficult questions 2 (inquiry-based), 19 (knowledge based), 20 (inquiry-based), 23 (inquiry-based) recorded a growth in the maximum gaining of points and a decline in the number of points with a zero score. It was again confirmed, even in such a small sample, that students do not have such a big problem with hypothetical questions, and without great difficulty they are able to write at least the minimum for gaining at least one point from the maximum point value, which amounted to three points.

Possibilities of connecting ICT with Inquiry-Based teaching from point of view of computer supported experiment

Within four levels of Inquiry-Based Science Education can be ICT implemented into computer aided experiment as follows (Mechlová, 2012):

Confirmation research

a) *Internet*. Searching for information and checking own answers, if necessary supplying other information concerning given topic. The teacher provides the student with web pages to help them find the information. The student will find the information in e-text.

b) *Teaching programs*. Practicing already discussed topic.

c) *Work with sensors*. Students follow the instructions. The result is known in advance. The purpose is to get acquainted with technologies which can be used during the

experiment and to confirm the correctness of the action (method) with respect to the outputs known in advance.

Structured research

a) *Work with sensors* following the task. Based on the measurements the student must evaluate on the results of the experiment. The student must analyze the result and deliver the conclusion in particular form answering the following questions: Why he/she executed the experiment? What did he/she found out?

b) *Preparation of presentation of their own results and justifying them.* Searching the internet for the information to confirm the obtained data.

Guided research

a) *Searching the Internet*. Searching for the information necessary to execute the experiment, following various simulations and animations connected with the experiment, an effort to optimize the experiment to the school lab conditions or outside it as an remote or virtual experiment.

b) *Presenting the experiment* to students in the class, justifying the method.

c) *Work with sensors. S*tudents execute the experiment, based on task given by a teacher. They choose their own suitable sensors. At first they analyze the strategy of executing of the experiment. They execute the experiment. Finally they will provide the following information: the aim of the experiment, reason the method of execution.

d) *Exploitation of all available technologies at school and beyond.* Individual students give proposals for solving the problematic jobs, in certain way also innovative methods. Publishing the job results and discussing them (social networks, school www network), preparing materials for interactive boards - supplementing the results of the experiment.

Open research

a) *Student's own proposals for experiments concerning the topic* presented by the teacher during the class-work. Students suggest their own experiments. They try to make use of sensors available at school. At the same time they try to suggest which sensors are necessary. They try to find out with the aid of the teacher and the internet whether the suggested sensors are available.

b) *Exploitation of all available technologies at school and beyond.* Individual students give proposals for solving the problematic jobs, in certain way also innovative methods. Students publish the results. The results of the experiment are discussed among other students (social networks, school www network). Students prepare materials for interactive boards - supplementing the results of experiment.

Possibilities of connecting ICT with Inquiry-Based oriented teaching from point of view of computer supported experiment

Inquiry-Based level / ICT activities	1. Confirming	2. Structured	3. Guided	4. Open
Work with the internet	5	5	5	5
Work with educational programmes	5	5	3	3
Work with sensors executing an experiment (real, virtual, remote)	5	5	5	5
Preparation of presentation on given topic	3	4	5	5
Presentation of executed experiment using available software tools and applications	2	3	5	5
Publishing of the experiment results and discussion (social networks, school network, www network)	1	2	4	5
Preparation of materials for inter-active board	1	2	4	5

Tab. 2: Possibilities of connecting ICT with Inquiry-Based oriented teaching from point of view of computer supported experiment (0 – never, 5 – very often)

Computer supported experiment in four varieties depending on the level of Inquiry-Based Science Education

As an example of teaching with ICT support can serve aforementioned experiment with carbon dioxide called „Carbon dioxide is a greenhouse gas“. The aim of the experiment is to make pupils realize the basics of greenhouse effect based on common gas carbon dioxide, which they encounter every day. Depending on their skills pupils work on different levels of IBE so that at the end of their work they acquire the knowledge in their own ways.

Please find the following task examples: *Greenhouse gas* in connection with real computer aided experiment.

Confirmation research

Execute an experiment with the title *Greenhouse gas*. Experiment is made to confirm data you were provided with in the class. It is important to learn to work effectively with sensors and to carry out computer aided experiment to validate the result know in advance. On the level of confirmatory research pupils know the procedure of the experiment and they are theoretically prepared in advance. Experiment with carbon dioxide as a greenhouse gas is described in advance. Pupils know the answers to the questions before they start performing the experiment itself.

Structured research

Please execute the following experiment titled *Greenhouse gas*. Inform all students in your class about the result of the experiment. Evaluate on your discovery. Specify why you made the particular experiment. It is assumed that the student works with the result he/she obtained during the experiment. It is not enough to execute an experiment and compare gained data with the results given in advance but to interpret all measured data correctly. Based on structured research, pupils know the procedure of given experiment but the difference is that they have to find out themselves why they did the experiment and to come up with the conclusion. They are prepared theoretically, so that after performing the experiment they are apt to explain the issue.

Guided research

Please execute an experiment to prove that *greenhouse gases cause planet warming*. Please suggest an experiment. Please suggest the method of executing the experiment. Inform all students in your class about the result of the experiment. Were all your hypotheses you made before executing the experiment confirmed? Are you surprised by the result? The student specifies his/her own method and sets the sensors, technologies if needed, he/she could use. The teacher gives him/her advice, guides him/her and discusses his/her choice. The method is given by the student. This level of research based teaching assumes the student is able to choose the technologies offered by school and is able to solicit them. Based on structured research, pupils know the procedure of given experiment but the difference is that they have to find out themselves why they did the experiment and to come up with the conclusion. They are prepared theoretically, so that after performing the experiment they are apt to explain the issue.

Open research

Please individually prepare experiment(s) that are connected with the topic *Greenhouse gases as a part of atmosphere*. What is the scope of your investigation? What would you like to look for? Is it possible to find the above stated information with the scope of opportunities given by school? Are there other possibilities how to find out introduced suggestions behind the school? Are there technologies and machines that can help you? How the mentioned technologies work? The student does not have any restrictions concerning the choice of the experiment or its execution, however the teacher provides support and guidance. The student also has to prepare and plan the experiment and chose the technologies. On level on opened research pupils working with greenhouse gases topic and carbon dioxide ask questions and create hypotheses. They think of procedures and suggest the experiment method and perform it.

Conclusion

Contemporary concept of biological and environmental education on primary schools provides suitable conditions to use IBE with ICT support, which should lead pupils to understand the essence of phenomenon and issues that exist in their surroundings. The teacher disposes of documents and theoretical resources for work in class. It is important to put them into practice in a way that leads towards necessary understanding of pupils.

Information and communicative technologies have a place in Inquiry-Based Science Education. New technologies give teachers and students various opportunities to solve problematic tasks and to make experiments that can get completely new dimension. There are more methods available for the participants to approach the technologies – ICT activities and Inquiry-Based Science Education. ICT are very often applied in practice. Didactic materials for ICT in teaching have been already prepared for Environmental education. Examples mentioned above prove, that students gain skills of using ICT in particular levels of research (confirming, structured, guided, open) when applying concrete research oriented teaching.

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