CONSTRUCTIVIST PRINCIPLES APPLIED IN PRIMARY SCIENCE EDUCATION

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The educational system in Slovakia is sometimes somewhat interpreted as full of unanswered questions. In this article you will find only two examples of them; two questions and two empirical explanations given as answers. The questions are constructed pragmatically, and may be also be reviewed with an open mind; similar as to how Slovak primary teachers may use a similar method to construct and demonstrate them.

THE QUESTION: WHY IS THE CLASS STILL SO NOISY? CHILDREN ARE CONVERSING PERIOD! IS IT CORRECT, WHEN I ALLOW THEM TO DO IT?

THE INTRODUCTORY ANSWER: A group work provides better possibilities for modification and further development of pupils' preconceptions than individual work. This defines why it is favourable when a primary teacher encourages pupils to participate in discussions about learnt topics. A teacher might endeavour to be democratic, however, he/she shall mainly be thought upon by pupils as a figure of authority. Pupils are able to recognise a teacher's qualification and skill, and find it relatively easy to extract information from the teacher. On the other hand, it is sometimes not so easy for pupils to discuss with a teacher certain ideas, even if the idea is connected with the learnt topic. However in contrast, in a contemporary group the same circumstances presented might be interpreted as a vice-versa situation. It is vital in searching for a successful result flowing out of educational acting to allow pupils free flow and to manipulate with their ideas. This should encourage pupils to verbalise ideas, and compare their ideas with ideas of pupils in the contemporary group. Pupils often tend to unknowingly think: if a teacher offers some idea I cannot be sure I am able to understand it (because of a different cognitive level), but if my schoolmate offers some different idea, the possibility I can understand it is much greater (because of comparisons made at an equal cognitive level). A willingness to change the pupil's preferred idea is often influenced stronger when the idea is of schoolmates' ideas.

WHY WE THINK THIS WAY?

Preconceptions are created mostly via a spontaneous learning, via in obtaining an everyday experience, via a satisfaction of a knowledge need. A preconception is an active system in which processes of transformation, integration and appropriation run continuously. Preconceptions (spontaneous concepts) seem to be as a result of a subject interaction with its surroundings; it contains explanations which are specific to the subject and which describe some of the subject interactions with the environment.

Children need to understand the world around, they need the explanations. They continuously try to find the best explanations and they use for it every available knowledge, experience, non-mature ideas, thinking and rationalization. Not enough experience in comparison to very strong need for explanations often cause a construction of ideas that are not corresponding with universal science ideas about the objects and phenomena.

But the preconceptions are the only tools the children use for decoding the reality. Children are not willing to change their preconceptions spontaneously. The ideas are very clear for them, meaningful, and evident; the ideas help them to understand the reality. For children of this age it is really not important if the preconceptions are not generally accepted and accomplished.

The construction of a preconception results from these facts:

- When children construct their idea about observed phenomena, they are able to consider only selected facts that are connected with the phenomena.
- Children look on things and situations only from own view.
- Children use to create unreasonable and non-logic interconnections of explanations and observed realities.
- Children use to make postulates which are set upon their preconception so strongly, that it is nearly impossible to contradict them.

- Children use factual realities for testing their postulates selectively. The facts which can disprove the postulate often use to be ignored.
- Children's ideas use to be connected with a concrete content and a context while they are used. The ideas usually cannot be applied on new situations.

If we ignore existence of the preconceptions, the children can strongly set upon the preconceptions, because they help them understand the reality better than ideas we ask them to learn and they do not understand.

If children can find out that their schoolmates have different and similarly substantial and convincing ideas, the stability of own preconception will be interfered, the changes can happen more easily. Also because of this fact it is very important to set in a class activities which appeal children to express their ideas in a social interaction of schoolmates. The teacher has a role of moderator; he/she should lead the pupil's discussion to make a conflict of the expressed ideas. The discussion which arises from the conflict can lead the pupils to make an offset out of own ideas. It is more than important, it is really necessary to allow pupils to share their ideas with schoolmates, it is necessary especially for a primary science education.

QUESTION NO2: WHAT WOULD BE A MAIN MEANINGFUL GOAL OF PRIMARY SCIENCE EDUCATION? WHAT SHOULD I TEACH MY PUPILS?

AN INTRODUCTORY ANSWER: Mainly we should discard the idea that graduated primary school pupils will be acquainted with a quasi-uniform knowledge system. Prior to the pupils attending school most of the mainstream pupils individually possess a very different and really unique knowledge system. If the main goal of the primary education is aimed at an averaging of the knowledge systems, we should accept the quasi-uniform knowledge system as a suitable output. However, the main goal should be more sophisticated. The main goal should be aimed at the potential of every individual child. The individual knowledge systems that the children brought with them to the school, should obtain an inner stability provided by relations between concepts inside of their knowledge system. We can reach this only with parallel development of cognitive skills. Furthermore we can say that not only pupil skills, but also combined difficulty defined specific features play a significant role. It is Important to realise that not only a developed knowledge system is the target aim of primary science education; but that the main meaningful and priority target of primary science education would be a development of scientific literacy (at an appropriate level).

WHY WE THINK THIS WAY?

The curriculum defines not only goals but also a content of a primary education. After reading it out we are able to construct a specific educational environment and offer pupils a specific possibility to acquire a specific knowledge. This approach can cause that we simply convert the content of the science education to a list of conceptions, propositions and theorems the pupils should master. The result is that the main goal of the primary science education is set this (or similar) way: pupils should get a "basic" knowledge and to acquire "basic" science skills. The education looses the important integrity and complexity. The result of the primary science education should be defined as a scientific literacy.

"Scientific literacy is the capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decision about the natural world and the changes made to it through human activity" (the definition of scientific literacy by organization OECD in a program of international students evaluation – PISA: http://www.pisa.oecd.org.).

Practically it is important to know that the institutionalised science learning should guarantee a development of scientific skills and attitudes (not only knowledge). Especially pupils should learn how to recognize and use relevant facts and information to construct effective conclusions and decisions. In this process, pupils should be able to identify, gather and interpret fact while they are solving situation of everyday life. They should be able to distinguish questions to which the science can offer answers and to which the science cannot offer any answer. They should be able to recognize results flowing right out of an observed reality.

The change of stabile system of preconceptions runs slowly and with difficulties, we need a lot of time and a good supportive system. The system should be based on a scientific attitude to a reality investigation because the similarity of children preconceptions with scientific hypotheses is not accidental.

STARTING-POINT:

Constructivist attitudes are not presently commonly used in Slovak primary schools. They are more often found on a second level of the educational system. A thinking which is required in a class where constructivism is applied is a radically different way of thinking compared to what is required in a common class where a transmission attitude is preferred. It is not possible to change the thinking of children from one day to another. Children already have some idea what the school asks from them. When the children are both introduced and exposed into very different school-class conditions, the children are liable to become confused and are likely to change and develop their way of their thinking. It would be a more favourable approach, if we can start with the constructivist approach from the beginning of schooling.

French project *La main à la pâte* (descriptive translation: Let's turn up our sleeves) uses the constructivism as a main idea for a constructing an algorithm used in the instructive method. The algorithm copies a scientific research method (Scheme 1). Pupils acquire knowledge via their own experimental activity in a cooperative group work. More information about the method you can find on a French web-side of the project (http://www.lamap.fr) or on a Slovak web-side of the project (http://pdfweb.truni.sk/vsr/). We hope that the project will help to fulfil a "constructivist" gap in a primary science education in Slovakia.

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Scheme 1: Algorithm of proceeding in the met

Tasks for pupils				Usage of notepad	Tasks for a teacher
1		I observe, manipulate...			...planning stimulating situation related to a chosen scientific problem...
2		I am curious, I pose questions...			...moderating posing questions, asking for an exacting of pupils ideas and questions meanings...
3		I form my ideas, I confront them with ideas of my schoolmates, ...			...asking for concretization of the expressed ideas, moderating of preconceptions' confrontations...
4		An elaboration of hypotheses in small groups of pupils...			...helping with formulating appropriate scientific problems and hypotheses...
5		Creating a technique for a verifying the hypotheses...	 ...via experiment,  ...via observing,  ...via survey,  ...via searching in documentation.		...moderating ideas confrontation (when the ideas in the working groups start to be clear)... ...approving chosen ways of hypotheses verifying...
6		I am verifying the hypotheses via chosen way or ways... (experiment, observing, survey, searching in documentation)			...providing material for a practical realisation of the chosen way of hypothesis verifying...
7		Listing acquired results for presentation...			...helping with a formal elaboration of the results...
8		Verifying validity of every hypothesis... ⇗ ⇘	 Hypothesis was not validated: I come again to point No 3.		...encouraging pupils and initiating a further investigative procedure...
			 Hypothesis was validated: I draw down the conclusions.		...helping with drawing the conclusion down and with a synthesis elaboration... ...proposing situation with a transfer.