Basic Science Process Skills in Primary Education Practice

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Introduction

- Development of ability to build up enough broad and usable knowledge system becomes the dominant target of primary science education.
- The mentioned complex ability is in fact a wide category which includes various partial abilities, for example the ability:
  - to observe,
  - to compare,
  - to classify,
  - to identify relevant elements,
  - to generalize,
  - to search for scientific problems,
  - to make a hypothesis, etc.

Introduction

- Concerning the scientific content we can make a connection between the mentioned abilities and the abilities used in the real **scientific process**. This tendency is known as an aspiration to implement **scientific inquiry** into educational environment.
- That is why we should more specifically speak about tendency to develop **science process skills** or tendency to develop **scientific thinking**.

Introduction

- The ability to think scientifically is a common ability, which is used for processing of **any kind of information**, not only the natural science content.
- The **integrated ability** to think scientifically is a complex of partial abilities which could be developed more or less **separately**.
- For methodological reason it would be better to **set the abilities apart** and to **analyze the conditions** which are required for its development.

Basic Science Process Skills

- to observe
- to communicate
- to measure
- to classify
- to inference
- to predict

Observational skill

- If we want the observational skill to be consciously used for getting as much information as is empirically possible to get, we should help the pupils to do the things they spontaneously do not do. The pupils have mainly problems with:
  - identifying relations between variables;
  - noticing important details in a case the details require concentrated and/or long-time observations;
  - noticing modifications or changes in the observed situation caused by various interventions.

Observational skill

- The most children have a feeling that many of the realities they already know well enough and that is why they are not able to observe it so they will be able to get more information about it.

Observational skill

- To provoke further observation we can instruct the pupils to obtain and describe the information which have been provided by particular senses.
- Pupils can obtain further information during discussion within and between working groups.
- the teacher's questions are perceived as a model or pattern of how the teacher thinks about the situation.

Measuring skill

- In primary school we should continuously develop understanding of qualitative and after that quantitative measurement (which means to functional use of the number).
  - The qualitative measurement means presence identification of the variable.
  - The quantitative measurement means amount specification of the variable.

Measuring skill

- The basic principle is that the pupil should have a possibility to empirically perceive all the phenomena at the same time, to be able to notice the difference (to measure the variable sequentially).
- The most difficult aspect of measuring skill which should be developed is the ability to use the universal measurement units.

Measuring skill

- For better understanding of the measurement process it is better to direct the pupils to create own measurement tools and units.
- To create own measurement tools can be differently difficult, mainly it depends on:
  - pupils´ experience they have with the measured variable;
  - the measure of the variable tactility;
  - how the pupils understand the variable (as a physical quantity).

Communicative skill

- The pupils should be directed to development of following skills:
  - to monologue compact topic, to initiate dialogue and intentionally tend it to get reasonable results referring to dialogue content and at the same time referring to person the dialogue is held with
  - to express own ideas and opinions by comprehensible way and argue for the ideas and opinions
  - to reproduce information own way
  - to present information in different ways
  - to spontaneously initiate discussion by own experience or interpretations

Classification skill

- Small preschool children are able to classify objects according to one property or attribute.
- Further they are able to classify the objects according to two or more attributes.
- Well developed skill can be characterized by ability to create categories of observed objects or phenomena and by ability to clarify the categorization of the object or phenomena into the created categories.

Classification skill

- Quality categories should be created so that all observed (considered) objects, phenomena, situations could be exactly assigned into only one of the created categories without any doubt.
- To do it well we should create not only the categories but also exact specification of each category.
- The activities aimed at classification development should not be lifted out of context of scientific investigation, respectively out of natural discovering.

Inference skill

- The inference and predicative skills are not aimed only on description and arrangement of the empirical data, they are trying to create interpretations, explanations and some predictions which have rather subjectivized value.
- It is important to teach pupils to understand a difference between observation and interpretation.
- The incorrect is to perceive the constructed interpretation as if it is reality, fact or evidence.

Inference skill

- The created interpretation joins actually acquired information with the previously obtained experience. It means that our experience helps us to interpret what is actually observed. More experience we have, better interpretation we can provide.

Predictive skill

- If the observed phenomena are interpreted well enough, the interpretations by themselves led the observer to create specific predictions.
- If we would like to develop the predictive skill we should help the pupils to create scientifically appropriate predictions.

Thank you for your attention