The Benefits of Inquiry-Based Science and Math Education as a Constructivist Pedagogy

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Nowadays there is a growing interest at international level for inquiry-based science and math education (IBSE). From the very beginning we have to state that the accent within IBSE is put on the learning effort of students. The modern didactic approaches avoid the term „teaching - learning", which supposes first of all the teacher's effort to ensure the transfer of the knowledge stipulated by the curricula. On the contrary, the pedagogy of IBSE is focused on the development of understanding, formation of skills and attitudes requested for an active life within knowledge-based society. IBSE projects help the teacher correctly guide the formation of so-called „big scientific ideas" which are the base for understanding and explanation of new phenomena, events or things. In this way, IBSE puts the basis for analysing and reasoning abilities, acquaints the students with learning strategies, which will be used by them during their whole life. IBSE is the result of empirical combination of several constructivist theories, such as: multiple intelligences, Bloom taxonomy, whole method, etc. Thus, IBSE is a strategy based on:

- Practical work of students – the first level of learning within IBSE. It is about advanced involvement of students or learning by doing. Here we have to underline that not every doing means automatically understanding. Often students may repeat within their group the actions of the teacher without realising the sense of the actions. So, the practical work of students doesn't have intrinsic cognitive value.
- Leveraging multiple intelligences. We have five senses and for a full learning we have to use all of them. From one hand, as there is no panacea for all diseases, there aren't universal didactical tools. Indeed, the modern teacher's panoply must contain a broad spectrum of processes and approaches for forming students' cognitive and questioning abilities. On the other hand, involving students' multiple intelligences, we get more students actively involved in the knowledge process. Finally, it is reflected directly in the academic success rate, because each student, based on his intellectual configuration, can choose his/her own learning path. Thus, the knowledge gained through the student's own investigation and involvement has a deeper character, reaching a level that contributes to the proper understanding of the world and the formation of student's cognitive personality.
- The sequential structuring of the knowledge process on two main levels. The first level involves the organization of the curriculum around above mentioned „big ideas". The students assimilate such an idea within an IBSE project during their own research. Organizing in such a way the curriculum allows to avoid dissipation of students' attention to many more concepts, which are apparently not interconnected and are therefore difficult to memorize. By default, big ideas shift the focus from memory to understanding. The second level concerns the organization of the lesson around three - four new scientific terms for students. This type of ported teaching helps students better understand and assimilate new terms, teaching them to express in a scientific manner with rich and active scientific vocabulary. It is a very important issue because it forms the so-desired lifelong learning skills.

What should teachers understand and know related to IBSE? Inquiry-based education has two sides: a) inquiry as a set of cognitive skills of students (namely this aspect determines the further educational path of the students as an autodidact); b) inquiry as a complex set of didactical strategies which may facilitate: understanding of scientific principles and concepts, development of research abilities and awareness about scientific research. Another important issue is that within IBSE there are differentiated goals in class, so all students are included. Thus, the teacher will structure his/her teaching goals in the following way: 1) for all students – the teacher will encourage them to explore and give appropriate explanations why things or phenomena are as they are; 2) for many students – we want them to recognize that some scientific ideas may be useful to them personally and to society and scientific research methods may be applied not only in science; 3) for some students – we can expect them to replace their naive explanations based on own intuition with scientific concepts and to be willing to advance in the scientific knowledge of the world.

The collaboration between students is crucial for IBSE. The collaboration is seen as a background for building understanding through the conversation of students which may be developed at group or class level within the lesson or with other persons or groups exciding the time frame of the lesson. An example of collaborative learning is peer instruction developed by Shatalov V. F. in '70 years of XXth century and E. Mazur in XXIst century.

Bibliography

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