THE MEANING OF AND NEED FOR "INQUIRY BASED SCIENCE EDUCATION (IBSE)"

Dear Readers!

It is clear from many studies that European students' interest in science, mathematics and technology has been declining while their grade levels have increased. Another alarming issue for Europe is recruitment of students for science and technology related careers. According to the ROSE Project results, extremely few girls wish to become scientists, and even for boys the percentage is low. And in Europe, around 50% of boys gave a positive response to the question: "I would like to get a job in technology", but very few girls indicated that they would like to pursue such a career option (Sjoberg and Schreiner, 2010). These kinds of results from project reports highlight the urgent need for more effective action on the teaching and learning of science in schools.

According to a report published by the European Commission, the science education community mostly agrees that pedagogical practices based on inquiry-based methods are more effective for the teaching and learning of science. However, the reality of classroom practice is that in the majority of European countries, these methods are only being implemented by relatively few teachers (Rocard et al, 2007). The report continues to explain the advantages of inquiry based science education (IBSE) and the recommendations clearly promote the use of IBSE for the teaching and learning of science in Europe.

The European Commission also placed importance on the inclusion of "IBSE" for the 7th Framework, Science in Society, Projects. A number of projects were initiated on IBSE, such as: ESTABLISH (European Science and Technology in Action: Building Links with Industry, Schools and Home), PARSEL (Popularity and Relevance of Science Education for Scientific Literacy), PROFILES (Professional Reflection-Oriented Focus on Inquiry-based Learning and Education through Science) and FIBONACCI (Disseminating inquiry-based science and mathematics education in Europe) have been carried out, or are currently operating.

When we consider that all of these projects have been built around inquiry based science education, we cannot help but ask the question "Do they all agree on one simple definition of inquiry?" I think it is an important question for all researchers who work on IBSE. I will try explore further in this editorial about the literature-based definitions of inquiry.

Actually, the term "inquiry," meaning, "search for truth," appears frequently in writings by philosophers but not so often in the work of social science researchers. The earliest known philosophical writings are thought to have been written around 1500 B.C. Then, as now, philosophers wrestled with questions about the nature of existence, knowledge, morality, reason, and purpose or meaning (Michael, 2002).

Wells (2001) argues that "Inquiry is not a 'method' of doing science, history, or any other subject, in which the obligatory first stage, in a fixed, linear sequence, is that of students each formulating questions to investigate. Rather, it is an approach to the chosen themes and topics in which the posing of real questions is positively encouraged, whenever they occur and by whoever they are asked. Equally important as the hallmark of an inquiry approach is that all tentative answers are taken seriously and are investigated as rigorously as the circumstances permit" Clearly the questions posed need to have some importance and it would be a direction for a more positive image of science if students were determining importance in this case.

When inquiry is more directly linked with teaching and learning of science, new definitions and approaches have appeared. According to Rocard et al. (2007), two pedagogical approaches in science teaching need to be contrasted: the first, the one most traditionally used is the "Deductive Approach". In this approach, the teacher presents the concepts, their logical – deductive – implications and gives examples of applications. The approach is from the general to the specific, from the law to the application or from the theory to the practice. The second referred to as the "Inductive Approach," gives students more space for observation and experimentation. The approach is from the specific trying to lead to the general idea, from the specific practice to the theoretical overarching idea and thus towards building up to the scientific law. The important aspect of the inductive approach is teacher-guided construction by the child of his/her own knowledge.

In the past ten years, the Inductive Approach is often associated with Inquiry-Based Science Education, mostly being applied to scientific investigations. According to Linn, Davis, and Bell (2003), inquiry is the intentional process of diagnosing problems and critiquing experiments, as well as distinguishing alternatives, planning investigations, researching conjectures, searching for information, constructing models, debating with peers, and forming coherent arguments.

Nevertheless, a number of other definitions can be found from official documents. According to the National Research Council (NRC) "Inquiry is a multifaceted activity that involves making observations; posting questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in the light of experimental evidence; using tools to gather, analyze and interpret data; proposing answers, explanations and predictions; and communicating the results. Inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations" (NRC 1996: 23).

These definitions show appropriate frameworks for students to develop basic scientific thinking skills. The all seems to recognize the importance of student-centred teaching approaches. However, there are still challenges to be overcome:

- To what extent do science teachers feel confident to promote teaching and learning environments for IBSE?
- Do science teachers have the necessary pedagogical skills to implement IBSE in their classrooms?
- Do science teachers have a clear understanding of the meaning of IBSE?

Some of the 7th frameworks projects are trying to address such questions, although additional studies are surely needed to implement IBSE in science classrooms more efficiently.

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