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The Current Paradigms of Science Education and Their Expected Impact on Curriculum

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Abstract

Science education is undergoing changes due to its increasing importance these days, as it faces economic and social challenges. Several science paradigms influenced and are still affecting science education. But these are unsatisfactory, and experts are trying to find a new paradigm. Using the PROFILES-project curricular Delphi study we try to identify stakeholders' views on science education as a base of a new paradigm. The main research outcome is three concepts: (1) awareness of science in current, social, globally relevant and occupational contexts, (2) intellectual education in interdisciplinary science contexts and (3) facilitation of interest in the contexts of nature, everyday life and living environment.

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Keywords: History of paradigms, Curricular Delphi study, paradigms, science education, stakeholders.

1. Introduction

We can register changes in STEM (Science, Technology, Engineering and Mathematics) education in most European countries as well as the USA (Osborne & Dillon, 2008). The reason is that STEM education has become even more important today, facing economic, environmental, and social challenges. Society has a task to prepare the younger generation for their adult roles as citizens, employees, managers, parents, and entrepreneurs (Pellegrino & Hilton, 2012; Rocard et al., 2007). We need a workforce with generally higher levels of STEM literacy for all students, as well as a sufficient number of highly gifted individuals entering scientific and engineering careers

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(Bybee & Fuchs, 2006). This new attitude involves especially knowledge and skills which are necessary for everyday life.

The expert commission of the EU "Science Education Now" (Rocard et al., 2007) stated that a new attitude to science education could increase the interest of young people in science. In order to be successful important curricular changes have to be accepted by all of the stakeholders in education: students, their parents, politicians and especially by teachers, who should implement these curricular changes into practice. Teachers do not accept changes which are forced upon them by administrators, policy-makers, etc. (Pajares, 1992; Raymond, 1997; Richardson, 1998; Lederman, 1999; Powers, Zippay, & Butler, 2006). Findings indicate that teachers' beliefs and practice were not wholly consistent, but nonetheless it is not easy to change them. According to Raymond (1997), there is inertia in teachers' beliefs.

We focused on the identification of views on science education, what opinions on current science education are held by stakeholders and what priority should be preferred in their opinion. We present the research results of the PROFILES-project curricular Delphi study on science education, which involved important conclusions about current paradigms of science education. Our research results could be an incentive for innovation in science education towards new requirements of society (science for life) and can support development of the new science paradigm.

2. Rationales

We defined the paradigm of science education as a set of basic postulates, approaches, contents, objectives and instruments which influence and cause the transformation of scientific knowledge into science education. There is a gap between science and science education, which have different objectives and research paradigms (Herron, 1999).

Science education is closely linked with the development of science but also with society's demands for STEM education. It used to be focused much more practically, especially on industry, agriculture, crafts and military applications.

The first school science courses (more than one hundred years ago) were taught in a descriptive way to use simple knowledge primarily for future work. Students were not encouraged to explore natural phenomena. This approach changed at the end of the 19th century with the rapid development of science, technology and industry application (e.g. gasoline engines, electrification). The science paradigm aimed at simple practice for life was replaced by more modern approaches. The teaching of science was still descriptive and practically oriented, but significant changes were in the broader content and increase of theoretical knowledge (Skoda & Doulik, 2009).

Several major science paradigms have emerged from the second half of the nineteenth century:

- Pragmatic (from the second half of the 19th century)
- Study of the nature (from the beginning of the 20th century)
- Simple science (from the beginning of the 20th century)
- Technological (from the end of WW2)
- Humanistic (from the 1970s)
- Scientistic (from the 1970s)
- Multidisciplinary (from the 1990s)

These paradigms strongly influenced and some of them (humanistic, scientistic and multidisciplinary) are still affecting science education (Skoda & Doulik, 2009). But most of them are outdated and unsatisfactory, and educational experts try to find some theoretical and empirical support for the creation of a new paradigm which would meet the requirements of all present stakeholders.

The search for a new paradigm of science education is an important research issue. This problem is a global problem because it is based on global social and technology changes. In the search for a new paradigm of science education it is necessary to consider future conditions such as:

- Rapid increase of STEM knowledge
- Wide application of STEM knowledge in daily life (Internet)