Mathematics Education -
Relevant, Interesting and Applicable

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Why and what is Inquiry Based Mathematics Education?

During the last decades a number of projects in Europe, several funded by EU, have aimed at developing, implementing and assessing inquiry based teaching activities at different levels of the educational system (Artigue & Baptist, 2012; Mass & Artigue, 2013; Ropohl, Rönnebeck, Bernholt, & Köller, 2016). Most of these projects cover mathematics as well as science, where the inquiry approach is more common. Inquiry in science often draws on already sensed experiences, which can be further studied in cyclic processes, which is difficult for many topics in mathematics. Here the cumulative nature of the discipline is a challenge (Artigue & Baptist, 2012). This short text will provide a brief overview of the idea of Inquiry Based Mathematics Education (IBME).

Origins of IBME

Almost a century ago the first ideas were developed that teaching in general should relate to students experiences and should be based on their actions. The educational researcher John Dewey is often associated with the phrase: “learning by doing”. He criticised the structure of curriculum for being the result of years of dealing with and rearrangement of knowledge, which might not fit students’ experiences and even create hindrance for students learning. Rather teaching should revolve around students’ actions (Dewey, 1902). Dewey (1938) emphasised the nature of inquiry and its role in learning and teaching – especially in science. To a large extend he regarded mathematics discourse as the way to order complex data and systematic treatment of outcomes of inquiry processes. The ideas of Dewey have been pursued by several others.

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Within mathematics Felix Klein played a key role in promoting a teaching more akin the activities of research mathematicians and their inquiry processes, which lead to the development of new knowledge. In the beginning of the twentieth century he introduced a reform programme for teacher education promoting practical instructions and the development of spatial intuition (Kilpatrick, 2008). Later George Polya published his book "How to solve it?" (1945), which has been deemed seminal in the problem solving approach to mathematics education. The book describes the problem solving activity, which mathematicians engage in when doing research. Emphasis is put on the role of problems and heuristic competences needed to solve these problems. Heuristic competences cover knowledge and strategies needed to address non-routine problems.

Different approaches to IBME

The solving of none-routine problems are corner stones in several approaches to mathematics education, which was further developed and some initiated in the 1970s: Theory of Didactic Situations (TDS), Realistic Mathematics Education (RME) and Problem Solving as line of research (Freudenthal, 1991; Brousseau, 1997; Schoenfeld, 1992). A shared idea in TDS and RME is, that students should be posed a non-routine problem, which they solve through the development of new knowledge. In TDS this is supposed to happen through adaption to what is called the milieu of the teaching situation (Brousseau, 1997). In RME the development of knowledge happens when students mathematize the phenomena, which the problem address. The theory differs between two notions for this process: vertical and horizontal mathematization (Freudenthal, 1991).

More recent research approaches to mathematics education which can be said to address IBME, have further studied the role of problems and how to make students pose problems. Especially problem posing literature and the Anthropological Theory of Didactics (ATD) address these issues (Singer, Cai & Ellerton, 2013; Chevallard, 2015). But also modelling as part of Mathematical Competence Theory can be said to nurture elements of IBME (Artigue & Blomhøj, 2013; Ulm, 2012).

IBME in MERIA

Research on the implementation of IBME indicate challenges with respect to teachers' certainty in IBME based teaching situations as well as institutional constraints and conditions can favour or hinder IBME initiatives (Hersant & Perrin-Glorian, 2005; Dorier & García, 2013). The MERIA project seeks to overcome these last challenges by designing course activities and a booklet introducing mathematics teachers at secondary level to IBME, RME and TDS, it will provide teachers with predesigned lessons and assist them in further development of RME and TDS based teaching designs.

References: www.meria-project.eu/activities-results/practical-guide-ibmt

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