

Mathematical Competence as It Is Defined through Learners' Errors in Arithmetic and Algebra

Authors : Michael Lousis

Abstract : Mathematical competence is the great aim of every mathematical teaching and learning endeavour. This can be defined as an idealised conceptualisation of the quality of cognition and the ability of implementation in practice of the mathematical subject matter, which is included in the curriculum, and is displayed only through performance of doing mathematics. The present study gives a clear definition of mathematical competence in the domains of Arithmetic and Algebra that stems from the explanation of the learners' errors in these domains. The learners, whose errors are explained, were Greek and English participants of a large, international, longitudinal, comparative research program entitled the Kassel Project. The participants' errors emerged as results of their work in dealing with mathematical questions and problems of the tests, which were presented to them. The construction of the tests was such as only the outcomes of the participants' work was to be encompassed and not their course of thinking, which resulted in these outcomes. The intention was that the tests had to provide undeviating comparable results and simultaneously avoid any probable bias. Any bias could stem from obtaining results by involving so many markers from different countries and cultures, with so many different belief systems concerning the assessment of learners' course of thinking. In this way the validity of the research was protected. This fact forced the implementation of specific research methods and theoretical prospects to take place in order the participants' erroneous way of thinking to be disclosed. These were Methodological Pragmatism, Symbolic Interactionism, Philosophy of Mind and the ideas of Computationalism, which were used for deciding and establishing the grounds of the adequacy and legitimacy of the obtained kinds of knowledge through the explanations given by the error analysis. The employment of this methodology and of these theoretical prospects resulted in the definition of the learners' mathematical competence, which is the thesis of the present study. Thus, learners' mathematical competence is depending upon three key elements that should be developed in their minds: appropriate representations, appropriate meaning, and appropriate developed schemata. This definition then determined the development of appropriate teaching practices and interventions conducive to the achievement and finally the entailment of mathematical competence.

Keywords : representations, meaning, appropriate developed schemata, computationalism, error analysis, explanations for the probable causes of the errors, Kassel Project, mathematical competence

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