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Prospective Primary School Teachers' and Pre-school Teachers' Beliefs about the Nature of Mathematics and Mathematics Learning[2]

Extended summary

University studies, among other things, are aimed at enabling primary school teachers and pre-school teachers to support the development of mathematical competences of young learners. Although mathematics content knowledge is a major component of the professional body of knowledge required for teaching mathematics, teachers' professional beliefs on what mathematics is and how mathematics is learned have a significant mediating effect on teachers' success in providing genuine opportunities for learning meaningful mathematics.

The goal of the research was to analyse prospective teachers' beliefs about the nature of mathematics and about mathematics learning. Studying teaches' beliefs (and knowledge) is motivated by the notion that teachers' beliefs (and knowledge) shape their actions and that teachers' practices impact students' development of mathematics proficiency.

The research reported in the paper is a preliminary study for a larger national project (The Beliefs of Prospective Primary School Teachers and Preschool Teachers about the Nature of Language and Mathematics and about Teaching and Learning Language and Mathematics), funded by Ss Cyril & Methodius University in Skopje. The sample of respondents for the preparatory study consisted of 102 first year students (89 female, 87 % of the sample) of the primary school teacher programme (71 respondents) or of the preschool teacher programme (31 respondents). The survey consisted of the beliefs scales related to mathematics, mathematics learning and mathematics achievement developed in TEDS-M (The Teacher Education and Development Study in Mathematics). The statements represent two views, not equivalent with,

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2 The research reported in the paper was conducted as a preliminary study for the project The Beliefs of Prospective Primary School Teachers and Preschool Teachers about the Nature of Language and of Mathematics and about Teaching and Learning Language and Mathematics, Ss Cyril & Methodius University in Skopje, FYROM.

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yet related to: conceptual and cognitive-constructivist orientations; calculational and direct transmission orientations. The survey was administered in the first week of the semester when the students encounter university mathematics instruction for the first time. A subsample of 71 students responded, on a voluntary basis, to three mathematics items designed to complement the survey beliefs scales.

A strong support for the statements expressing beliefs consistent with the conceptual orientation (Mathematics as a process of inquiry) and the cognitive-constructivist orientation (Learning mathematics through active involvement) emerged from the responses; approximately 75 % of the respondents agreed or strongly agreed with them. At the same time, 75 % of the respondents also endorsed the calculational view of mathematics (Mathematics as a set of rules and procedures). The direct-transmission orientation (Learning mathematics through teacher instruction) received support by only 1 in 5 respondents. Less than 1 in 10 respondents expressed a strong endorsement of views of 'Mathematics as a fixed ability'.

The results revealed a difference between the self-professed beliefs of the students and the approaches they used to respond to the mathematics items. Although the vast majority of the respondents unequivocally supported the belief that mathematical problems can be solved in many ways, when asked to choose whether one or more pictorial representations accurately model a given example of fraction multiplication, more than half of them focused on finding only one representation, although three of the four representations were correct and two of them were almost indistinguishable. The responses to the second mathematics item brought forward the established mode of doing mathematics by universally applying formulas whenever possible, or not possible, and when applying simple logic would be much more productive. Enabling future teachers to carefully select when it is most appropriate to apply formulas, by designing mathematical activities in which solving problems using reason, instead of a senseless application of formal procedures, has to be one of the primary tasks of teacher education mathematics courses. This argument also refers to the results obtained on the last mathematics item when respondents were asked to identify a strategy an 11-year old pupil would be expected to use when finding the area of a triangle. An overwhelming majority of the respondents tended to choose a formula, any formula, even when it was impossible to use it, or even when it required certain higher level of mathematics knowledge, not accessible to an average pupil in primary grades. It seems that university education of future teachers has to address a deeply rooted habit of mind of disregarding common sense and logic in favour of an unselective use of formal mathematical procedures.

These findings point to the need for providing specific learning opportunities within initial teacher education to help future teachers in developing coherent mathematical knowledge for teaching and consistent professional beliefs. Simply introducing new, reformed mathematics (and mathematics methods) curricula is not enough. Teachers' beliefs and knowledge develop as a result of their learning experiences since early age ('years of apprenticeship'), and the process of mathematics learning (and of becoming a teacher of mathematics) is a process of 'enculturation', of becoming a member of a community of learners of mathematics.

Keywords: mathematics education, primary school teachers, preschool teachers, professional knowledge, beliefs.

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