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# First-year teacher students' mathematical beliefs

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*This poster focuses on the beliefs accompanying first-year teacher students with respect to aspects of mathematics as a product of human creativity that might be designed in various ways.*

**Keywords:** Teacher education, mathematical beliefs, genetic teaching.

## INTRODUCTION

Transition issues are a frequent problem in academic mathematics education, particularly appearing in teacher students' education. Currently, there are several projects intervening in this field in German-speaking countries (e.g., Beutelspacher, Danckwerts, Nickel, Spies, & Wickel, 2012). We created a lecture, "Mathematical Genesis", held parallel to the corresponding calculus course in which the transition gap seems to be at maximum. The lecture deals with the development of mathematics in and by the society of mathematicians. First-year students learn about the importance of creativity and experience the process of developing mathematics. This study assesses effects of the lecture on their beliefs (cf. Weygandt & Oldenburg, 2014).

## THEORETICAL FRAMEWORK, METHOD AND RESULTS

This research is based on Törner's theory and conclusions about German math teachers' beliefs, in which

he stated the "key role [of beliefs] in the teaching and learning process" (Törner, 1996). Moreover, Törner, Grigutsch and Raatz (1998) identified four aspects of mathematics: "formalism-", "scheme-", "process-" and "application-aspect". Only the "process aspect" corresponds to the genesis of mathematics. Our initial hypothesis stated that this should be analysed in more detail as more aspects of mathematics that might be especially important in the beginning of academic mathematics education appear to exist. We adopted Törner's survey on prospective teachers' mathematical beliefs and added 60 items focussing on lecture-related subjects. During the course of the study we surveyed 178 first-year (mixed math and math teacher) students concerning their acceptance of each statement. Exploratory factor analysis of the 37 test items (introduced by Törner et al., 1998) verified those four factors with good reliability. An analogously conducted factor analysis of the newly designed 60 items suggested the exploration of five further factors. The extracted factors are homogeneous concerning their content. Thus we propose to add the following aspects to those postulated by Törner (1996): (a) "output efficiency", (b) "structure of mathematics", (c) "creativity" and (d) "universality". The aspect (e) "latitude" can probably be included as well. In order to get an idea of these new factors, Table 1 illustrates three aspects through corresponding example items.

The current research concentrates on an inter-aspect correlation matrix and compares the pre- and post-

aspect	example item(s)
(b)	Learning maths, it's a waste of energy to take a non-productive approach.
(d)	Mathematical objects are comparable to natural principles, i.e., they may be discovered, but are unchangeable. / Any extra-terrestrial intelligence would reach same mathematical conclusions.
(e)	If one dislikes the consequences of a definition, one may modify the definition accordingly.

**Table 1:** Example items for some of the five assumed aspects

aspect shift \ group	attending MG (n=15)	not att. MG (n=22)
scheme-orientation decreases	$d=-.70$ ( $p=.02$ )	$d=-.45$ ( $p=.04$ )
structure of mathematics increases		$d=.60$ ( $p=.01$ )
universality decreases	$d=-.61$ ( $p=0.03$ )	
latitude might increase	$d=.49$ ( $p=.07$ )	
application might decrease	$d=-.43$ ( $p=.08$ )	
output efficiency might decrease		$d=-.35$ ( $p=.09$ )

**Table 2:** Effect sizes of differences in mean values

test results of teacher students having or having not attended the lecture on “Mathematical Genesis” with the corresponding effect sizes in Table 2.

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