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## ► To cite this version:

Evelyn Süss-Stepancik, Stefan Götz. Beliefs and expectations at the beginning of the bachelor teacher training program in mathematics. Eleventh Congress of the European Society for Research in Mathematics Education, Utrecht University, Feb 2019, Utrecht, Netherlands. hal-02422760

**HAL Id: hal-02422760**

**<https://hal.science/hal-02422760>**

Submitted on 23 Dec 2019

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# Beliefs and expectations at the beginning of the bachelor teacher training program in mathematics

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*Keywords: Beliefs, expectation, student teachers, mathematical training, factor analysis.*

## Introduction

Since 2016/17, a new bachelor teacher training program has been implemented in a cluster of four tertiary education institutions in the North East of Austria to provide a common secondary level teacher training program. The education of future maths teachers in mathematics as a science is separated from the program for other maths students. The first compulsory lecture for future maths teachers is an introduction to university mathematics. It offers mathematical terminology, parts of the mathematical toolbox and methods of proving. Thus the students' beliefs, which are already developed due to their school experience, are faced with mathematics at university level.

## Contextualising our study in the field of belief research

In the field of mathematical belief research, the pivotal work of Grigutsch, Raatz, and Törner (1998) is well known. It deals with maths teachers' beliefs and shows that the beliefs of mathematics teachers represent four main dimensions: scheme, formalism, process and application. Rach, Heinze, and Ufer (2014) also follow that conception, but they focus on specific expectations of students in terms of relevant learning opportunities. They found that students' expectations are mostly realistic and have a small influence on the students' success. In our approach, we incorporate both the beliefs and expectations of future math teachers. We define the following research questions:

1. Which beliefs and expectations do student teachers hold at the beginning of their maths study?
2. Which significant changes can be observed between the beginning and the end of the first term?

## The inquiry instrument and a description of the setting

We developed a questionnaire similar to Grigutsch et al. (1998) and "Mathematics teaching in the 21st Century (MT21)" (Schmidt, 2006, Part C). It is divided into two parts: the first 41 statements deal with the personal view of mathematics; the second part consists of 19 statements to investigate subjective expectations. In both sections, different four-point Likert scales are used to measure the level of agreement with the given statements. The first one spans from *strongly agree* (1) to *strongly disagree* (4), the second one from *fully* (1) to *not at all* (4). An example of the first part is: *If one doesn't know the correct procedure to solve mathematical tasks, then one is lost.* And from the second part: *My mathematical education qualifies me to learn prospective and unknown content of the subject curricula on my own.* We surveyed students before and after attending their first mathematical course in 2017/18 (winter term) using the same questionnaire. 374 students participated in the pretest, 186 in the posttest. The paired sample has a size of 150 participants.

## Evaluation process

An exploratory *factor analysis* was carried out to get an insight into the beliefs of the young student teachers. The data from the paired sample were tested by the *Wilcoxon test* for significant differences (caused by the attended lecture) between the data of the pretest and posttest. Finally, *frequency distributions* were generated for each factor regarding the pre- and the posttest in order to explain the detected differences. Data analyses were conducted using SPSS.

## Results

From three relevant factors, two should be mentioned here. The first one contains 16 items (Cronbach alpha 0.869, explained variance 11.990 %). This factor contains items like: *My mathematical education empowers me to follow mathematical in-service trainings*. It can be interpreted as, “Autonomy concerning the subject teaching design”. This shows that future maths teachers have specific expectations concerning their mathematical training at the beginning of their study. It seems that the conviction of becoming experts in mathematics made a considerable shift ( $p = 0.027$ ): from *fully expect* (69.51 % to 55.67 %) to *expect partially* (29.27 % to 41.24 %). Although the relative frequency of *hardly expect* is small, it increases by a factor of more than 2.5.

The other factor refers to mathematics without practical utility (two items, Cronbach alpha 0.817, explained variance 3.697 %). One statement with negative loading is given for illustration of this belief: *Many aspects of mathematics have practical relevance*.

## Discussion

Regarding the first factor, the results indicate that the first maths lecture, “Introduction to mathematics”, cannot fully answer the students’ expectations. The originally strongly anticipated expectations of getting more mathematical autonomy had decreased. In the light of Shulman’s (1987) conceptualisation of content knowledge, the described changes are hardly conducive.

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