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**INFLUENCING FACTORS ON PROFESSIONAL
IDENTITY OF MATHEMATICS TEACHERS DURING
UNIVERSITY EDUCATION**

ABSTRACT

This study reports results of the project “Professional Teachers’ Activities to Promote Subject-Based Learning” of the University of Hamburg from the year 2018. 374 future (mathematics) teachers were asked about their professional identity. The purpose was to examine what factors have an influence on their weighting of three aspects of the teacher role: “mathematician/scientist”, “didactician” and “pedagogue”. The results show that pre-service mathematics teachers feel more like scientists whereas teachers without STEM subjects do not. Furthermore, a development from scientist to didactician can be observed in the course of university education. Another purpose was to examine if there was an “ideal” professional identity. Results indicate that there is a broad consensus on the weighting with a “pedagogue” ideal of the elementary school and a “scientist” ideal of the high school.

INTRODUCTION

The professional identity of (prospective) teachers is of particular importance, as it has a great influence on their teaching style, on how they develop in their profession and on how they deal with changes in the educational landscape (Bullough 1997). In this respect, the development of an adequate professional identity is seen as an important task of university teacher education. Previous studies show that the professional identity of in-service teachers is a continuously evolving construct. It differs in both constitution (van Veen et al. 2001) and development (Beijaard et al. 2000) depending to a considerable extent on the subject taught.

However, professional identity has been examined mainly among in-service teachers and with qualitative methods. Thus, there are only few results on pre-service teachers. This study reports results from the Hamburg project “Professional Teachers’ Activities to Promote Subject-Based Learning”, in which the professional identity of pre-service/student teachers of mathematics was examined with regard to two questions:

- (1) How large are the differences in the self-image of professional identity depending on the teacher education program, the grade level and the studied subjects?
- (2) Are there (consensual) ideal images of professional identity for different school types?

THEORETICAL FRAMEWORK

Following Fischer & Ehmke (2019) there are different dimensions of professional identity, ranging from social to epistemological beliefs. One dimension can be described as beliefs about the teacher role (“self”). These refer to one’s own understanding of the teacher role and self-image, but also to one’s abilities, tasks and responsibilities. In order to operationalize this dimension of professional identity, studies by Brovelli (2014) were taken up in which three aspects of the teacher role are distinguished, based on Shulman’s (1987) classification of teacher knowledge:

- a) “mathematician/scientist” refers to content knowledge (factual and conceptual knowledge of mathematics as a discipline)
- b) “didactician” refers to pedagogical content knowledge (knowledge about the teaching and learning as well as to curricular knowledge)

c) “pedagogue” refers to general pedagogical knowledge knowledge of classroom-management, diagnostics etc.)

STUDY DESIGN

Sampling

The study was conducted in the summer of 2018 as a voluntary online survey among all teacher students of the University of Hamburg. The sample consists of 374 pre-service teachers who were asked about their professional identity. 70 persons study mathematics and another STEM subject, 69 study mathematics and a non-STEM subject and 235 study neither mathematics nor a STEM subject. The sample is divided equally between bachelor and master students and equally between future primary and secondary school teachers.

Instruments

The student teachers were given a brief description of the three aspects of professional identity: “mathematician/scientist”, “didactician”, and “pedagogue”. They were then asked to distribute 100 points between the aspects “scientist”, “didactician”, and “pedagogue” (Brovelli 2014) and therefore had to weight the aspects according to the importance. On the one hand, this distribution should be given with regard to one’s own current professional identity and on the other hand with regard to an ideal-typical distribution for primary and secondary school teachers.

Data Analysis

Regarding the self-image the data has been analyzed separately for the aspects “scientist”, “didactician”, and “pedagogue” of professional identity. A three-way analysis of variance was conducted on the influence of the independent variables (teacher education program, degree level, studied subjects) on the weight of each aspect. Teacher education program included two levels (primary school, secondary school), degree level included two levels (bachelor, master) and studied subjects included three levels (mathematics and STEM, mathematics and non-STEM, two others).

Regarding the ideal image the data has been analyzed analogously, but with each aspect as within-subjects variable (school type) which included two levels (elementary school, grammar school).

RESULTS

Table 1 shows the results of the three-way analysis of variance for the self-image of professional identity in detail. Any interaction effects cannot be reported for space reasons. For the aspect “scientist” there was a main effect for the degree level ($p < .01$), such that bachelor students ($M = 37.3$, $SD = 22.3$) weight this aspect higher than master students ($M = 29.2$, $SD = 15.9$). Another main effect for studied subject ($p < .01$) indicates that students with subjects mathematics and STEM ($M = 41.5$, $SD = 22.4$) weight this aspect higher than students with mathematics and non-STEM ($M = 33.0$, $SD = 18.0$) or students with neither mathematics nor STEM ($M = 31.2$, $SD = 19.1$).

For the aspect “didactician” there is only one main effect for the degree level ($p < .01$) indicating that bachelor students ($M = 29.6$, $SD = 13.9$) weight this aspect lower than master students ($M = 33.0$, $SD = 10.1$).

For the aspect “pedagogue” the main effects teacher education program and studied subjects were significant ($p < .01$). Future primary school teachers ($M = 38.1$, $SD = 17.0$) weight this aspect higher

than future secondary school teachers ($M = 32.1$, $SD = 16.7$). Furthermore students with subjects mathematics and STEM ($M = 29.7$, $SD = 16.2$) weight this aspect higher than students with mathematics and non-STEM ($M = 34.6$, $SD = 18.0$) or students with neither mathematics nor STEM ($M = 37.2$, $SD = 16.7$).

| Aspect | Factor | df | F | p | η_p^2 |
|-------------------------|----------|----|-------|------|------------|
| mathematician/scientist | degree | 1 | 13.64 | .000 | .036 |
| | subjects | 2 | 6.57 | .002 | .035 |
| didactician | degree | 1 | 8.38 | .004 | .023 |
| pedagogue | program | 1 | 9.27 | .003 | .025 |
| | subjects | 2 | 6.77 | .001 | .036 |

Table 1: Three-way analysis of variance for the self-image
(statistically significant main effects ($p < .01$) only)

Table 2 shows all statistically significant main effects of the four-way analysis of variance for the ideal image of professional identity for different school types. The only between-subjects main effect that was statistically significant ($p < .01$) is teacher education program, indicating that future primary and secondary school teachers differ in the weighting of the aspects “scientist” and “pedagogue” for the school types elementary and grammar school. The within-subjects main effect was statistically significant ($p < .01$), such that the ideal weighting of the aspect “scientist” is much higher for high schools ($M = 40.4$, $SD = 14.0$) than for elementary schools ($M = 18.6$, $SD = 10.6$). And vice versa the ideal weighting for the aspect “pedagogue” is much higher for elementary schools ($M = 49.5$, $SD = 14.0$) than for grammar schools ($M = 26.3$, $SD = 12.8$).

| Aspect | Factor | df | F | p | η_p^2 |
|-------------------------|---------|----|--------|------|------------|
| mathematician/scientist | program | 1 | 20.26 | .000 | .054 |
| | school | 1 | 484.17 | .000 | .578 |
| pedagogue | program | 1 | 10.46 | .001 | .029 |
| | school | 1 | 532.51 | .000 | .601 |

Table 2: Three-way within-subjects analysis of variance for the ideal image
(statistically significant main effects ($p < .01$) only)

SUMMARY AND DISCUSSION

Regarding the self-image of professional identity the higher weighting of the aspect “scientists” of pre-service teachers with mathematics and STEM is in line with results of van Veel et al. (2001), who reported this for in-service teachers with STEM subjects. Furthermore, the influence of the degree level on this aspect as well as on the aspect “didactician” is an indication that the development from “scientist” to “didactician” of in-service teachers, as reported by Beijaard et al. (2000), also takes place during university teacher education. The lower weighting of the aspect “pedagogue” of pre-service teachers with mathematics and STEM subject also fits the results of van Veel et al. (2001). In addition, the higher weighting of this aspect of future primary school teachers compared to secondary school teachers can be explained with different weightings in the curriculum.

Regarding the ideal image for different school types, the fact that all main effects, except for teacher education program for two aspects, were not statistically significant speaks for a broad consensus on the weighting of all three aspects. In addition, the large effect sizes of the main effect school type point to a clear “pedagogue” ideal of the elementary school and a clear “scientist” ideal of the high school. The aspect “didactician” is regarded as equally important for both school types.

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