

Teacher students' beliefs about teaching physics and their teacher education

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It is beyond doubt that teacher education plays a crucial role in development of the educational system. Following the educational reconstruction for teacher education model [1] a clarification of teacher students' beliefs seems mandatory in order to improve the education of future physics teachers. Main aim of this PhD project was to determine beliefs of physics teacher students about high quality physics instruction at school. Therefore, interviews with 23 physics teacher students and an additional case study with six teacher students were carried out. Several beliefs of teacher students' e.g. *experiments causing a better retentiveness of physical contents* were found.

1 Theoretical Background

It is undisputed that teachers' pedagogical content knowledge (PCK) plays an essential role for the creation of successful and fruitful learning environments. One of the first empirical hints of PCKs relevance was given by the COACTIV study in mathematics education where researchers found that teachers' distinct PCK influences pupils' achievements to a high degree [2]. A transfer of these research outcomes to the area of physics cannot be done without empirical evidences. Although different projects in Germany worked on replicating these results, it seems that in physics classes processes are different than in mathematics classes (see e. g. [3; 4]). Nevertheless, the importance of PCK for constructing effective teaching and learning environments is out of question. Therefore, it seems to be of great importance to investigate how this basis of professional knowledge is integrated into teacher education and how teacher education can be optimized.

According to Riese [5], teachers' professional competences consist of two main parts: teachers' professional knowledge (divided into content knowledge - CK, pedagogical knowledge - PK and PCK) and motivational, volitional and social dispositions and capabilities (separated in beliefs systems and motivational orientations). In contrast to knowledge, beliefs rest on subjective valuation, they are independently of one another [6] and not inevitably logical or rather fragments [7].

Furthermore, the focus of the presented study is the contribution to an enhancement of teacher education and offer learning opportunities in which the professionalization of physics teacher students' is improved. In the current study we aimed to understand the beliefs, which pre-service-teachers have prior to instruction on physics education.

2 –Research Design

In order to design courses in physics teacher education, not only the clarification of the subject matter (in this case physics education) but also the knowledge about learners' (here physics teacher students) is required [1]. Thus, the conducted study focused on the following research questions: Which beliefs do physics teacher students have about high quality physics instruction at school and which wishes do they have concerning their teacher education?

The study is divided into two phases: to get an overview of teacher students' beliefs, an interview study was conducted first. This was followed by a second phase, a case study, to get deeper insight on teacher students' beliefs.

Consequently, a cross-sectional study with semi-structured interviews with 23 teacher students was undertaken in a first step to detect teacher students' general thoughts concerning teaching and learning of physics as well as their wishes regarding their teacher education. Within this study, an inductive category system was developed covering all found beliefs. Several indications of the first phase, especially interesting hints of teacher students' beliefs about experiments, led to another research question: Which beliefs do physics teacher students hold in the area of 'experiments in physics classes'? More precisely, we were interested in beliefs concerning functions, learning efficacy, implementation and objectives of experiments in physics classes. To get insight into changes of physics teacher students' beliefs, a further research question was added: 'How will their beliefs change over the course of the next six semesters?' Consequently, six case studies were conducted focusing on the investigation of physics teacher students' beliefs of experiments in physics classes. Teacher students were interviewed at the beginning of their teacher education and then again approximately three years later to detect changes in their beliefs.

3 Results and Conclusions

General beliefs of physics teacher students about good physics lessons are, for example, "making the classroom interesting", "refer to everyday life" and "pointing out practical relevance" as well as "conducting experiments". Wishes of physics teacher students for their education are "more practical school training especially in teacher education", "input covering best practice examples, practical advice, guidelines" as well as "knowledge acquisition about knowledge transfer of physics content". Additionally, physics teacher students are looking for connections to their future job as teachers within their courses. Results of the longitudinal study reveal that the belief of "experiments causing a better retentiveness of physical contents" is particularly resilient.

Based on the findings, suggestions for future teacher education are made. Especially the developed system of categories of physics teacher students' beliefs provides a profound basis for a didactical reconstruction [1] of future courses in physics teacher education.

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