

Coherence in mathematics teacher education

A deficit of traditional teacher education, is the fragmentation of teachers' professional knowledge in single disciplines. While general measures from questionnaires are available, there is only little knowledge about student teachers' perception of the complex interplay of their study areas, i.e. their perception of coherence. The present interview study investigates student teachers' perception of coherence in mathematics teacher education. While recent studies report findings about coherence between theory and practice, we focus on coherence between mathematical content knowledge and pedagogical content knowledge. We firstly identify inductively fields of knowledge that student teachers consider as relevant for their future profession as mathematic teachers. By means of qualitative content analysis we confirmed this category system deductively. Secondly, we investigate existing or required coherence relations of these categories in teacher education. On the basis of these studies and further theoretical knowledge known from literature, we intend to develop a quantitative instrument to survey student teachers' perception of coherence in teaching.

1. Aims

Subjective factors are highly relevant for student satisfaction and success in university study. While general measures from questionnaires are available, there is only little knowledge about students' perception of the complex interplay of their study areas (that is: coherence). The objective of the present interview study is to contribute to our knowledge about university students' perception of coherence in mathematics teacher education. We further focus on coherence conceptualized as an integration of content knowledge (*ck*) and pedagogical content knowledge (*pck*). By means of interviews we investigate whether the coherence between *ck* and *pck*, as intended by the learning opportunities, can be detected in the perception of the teacher students. The present work thus aims at empirically identifying relevant aspects of coherence that are either known from literature (mostly normative) or not yet discussed. The results are used to construct a quantitative questionnaire, which allows to survey students' *perception of coherence*.

2. Theoretical & Educational Significance

In teacher education the acquisition of knowledge in the areas of content knowledge (*ck*), pedagogical content knowledge (*pck*) and pedagogical knowledge (*pk*) play a crucial role (Shulman, 1986). In particular, there is empirical evidence that pupil's learning success depends significantly on these three types of teacher knowledge (Darling-Hammond, 2000; Kunter et

al., 2011). Studies show that ck, pck and pk as parts of teachers' professional knowledge do not coexist in unrelated fields but for experienced teachers they constitute a cross-linked synthesis (Bromme, 1997; Depaepe et al, 2013). A deficit of traditional teacher education, however, is the fragmentation of teachers' professional knowledge in single disciplines - very few learning opportunities were offered which promote the integration of the different fields of a teacher's professional knowledge (for mathematics teacher education e.g. CBMS, 2012). While recent studies investigate the coherence between theory and practice in teacher education (Canrinus et al., 2015) there are only few efforts to investigate teacher students' perception of coherence between the subject-related elements (ck) and the pedagogical elements (pk, and pck) of their studies. In order to prepare teacher students for their professional career, convenient knowledge structures should be created and fostered already in university education.

3. Methodology and research questions

Fifteen teacher students of the University of Freiburg, who are all aiming to be high school teachers, were investigated by semi-structured interviews. The interview guide comprises ten questions which were divided in four sections:

Section 1: questions about relevant knowledge, skills and learning opportunities that teacher students desire to meet at university.

Section 2: questions about relevant knowledge of mathematic tasks and learning opportunities for professional handling with tasks that teacher students desire to meet at university.

Section 3: questions about perceived coherence between the mentioned types of knowledge and qualities of desired „coherent learning opportunities“.

Section 4: questions about situations, contents and learning opportunities which are perceived as not suitable for teacher profession, and how one could transform these into suitable learning opportunities.

The interviews had a duration of approximately 30 minutes, they were all recorded on minidisk, and transcribed. The a priori coding system contained three dimensions: A) General Knowledge and Skills, B) Types of learning opportunities, C) Qualities of learning-opportunities. Following the qualitative content analysis of Mayring (2014), the following research questions are addressed: (1) Which categories for describing each dimension were developed inductively in the first analysis and were elaborated for each dimension of the coding system? (2) Which of these categories can deductively be con-

firmed by a second analysis (performed by two trained raters independently)? (3) Which coherence-relations between the categories can be detected empirically?

4. Preliminary Findings

The inductively detected categories (question 1) for dimension A are identical to those, which are reported in the Michigan group's mapping of mathematical knowledge for teaching (MKT, Hill et al., 2008). While the categorization of Hill et al. (2008) is based on data of primary teachers the results of our study are based on high-school student teachers. The Michigan group's categories thus seem to be useful to conceptualize MKT of high-school teachers as well. Additionally, the categories of dimension B are close to the theoretical dichotomy of Shulman (1986), that is: students name learning opportunities building up CK, those building up PCK and those building up PK. Finally, qualities of learning opportunities are said to be dependent on content, pedagogy and methodology. It's still an open question whether these results can be confirmed deductively (question 2) and whether coherence between these categories (coherence between aspects of MKT; coherence between CK, PCK and PK; coherence between content, pedagogy and methodology) is highlighted by students to support students learning at university (question 3).

5. References

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