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Introduction

Algebra is central in mathematics education in secondary school: in problem solving, in representing relationships and functions, in describing patterns and structures, as a language. Algebra education aims at integrating procedural skills and conceptual understanding (Drijvers et al., 2011). This requires good mathematics teachers, who have sufficient content knowledge (CK) as well as pedagogical content knowledge (PCK). Learning to teach, however, takes time and is complex (Korthagen, 2010). At the same time, in the Netherlands, teachers are given full responsibility for their own classes from the start of their career. This means that the mathematical knowledge for teaching of pre-service teachers needs to be at a high level. To improve their pedagogical content knowledge (PCK), and, if necessary, the corresponding content knowledge (CK), we need to identify the omissions in their knowledge. PCK, however, is a complex concept that is hard to measure. Ball et al. (2008) have elaborated the knowledge needed to teach mathematics into the Mathematical Knowledge for Teaching (MKT) framework. The goal of the study presented here is to find out whether there exist instruments to measure MKT for algebra teaching in lower secondary education, appropriate for the Dutch context. This is done by conducting a meta-study on existing instruments. The poster will report on the meta-study, its methods, its results and its conclusion.

Theoretical Framework

Next to CK, teachers also need PCK (Shulman, 1986). Within mathematics education, especially at the University of Michigan, research has been conducted into the nature of CK and PCK of mathematics teachers, by collecting data from mathematics lessons in practice, and by analyzing and categorizing these data. This resulted in 2008 in a subdivision of MKT. Parts of the subdivision focus on general CK and PCK, and parts of the subdivision focus on the teaching practice itself: Specialized Content Knowledge (SCK), Knowledge of Content and Students (KCS) and Knowledge of Content and Teachers (KCT). SCK is the mathematical knowledge needed to teach, such as: being able to answer a “why” question. Central to KCS is the knowledge of students' thinking, and of their misconceptions about mathematical subjects. Central to KCT is the design of the instruction, for instance the order of the examples that are used.

Research question

The research question we want to answer is: to what extent are instruments, developed to measure mathematical knowledge for teaching algebra in grade 7-9, appropriate for measuring pre-service teachers’ SCK, KCS and KCT in the Netherlands?

Method

We have conducted a literature review. Keywords used were SCK, KCS and KCT, algebra, (variants of) pre-service education. The databases searched were ERIC, Web of Science, Scopus and PsychInfo. Because the first search yielded a review article (Kim, 2018) in which all measurement instruments of MKT up to 2012 are listed, we restricted the search to the timeframe from 2012 to present. The articles found were analyzed on the measurement of SCK, KCS and KCT for algebra within pre-service teacher education. For example, the target group, tasks of teaching and categories of knowledge were considered to decide to what extent the instrument would be appropriate for the Dutch context. Criteria used in this evaluation, such as the role of conceptual understanding and the extent to which SCK, KCS and KCT are measured separately, will be presented in the poster. The search resulted in fifteen articles.

Results

Findings show thirteen instruments, ranging from the instrument for measuring Knowledge for Algebra Teaching (McCrory et al., 2012) which has been extensively tested and validated, to a questionnaire. Some instruments focus on one particular topic (for example variable). Most instruments consist of items that mainly measure SCK, next to Common Content Knowledge. In general there is no breakdown into the three different domains SCK, KCS and KCT. The instruments and their applicability to the Dutch context will be presented in the poster.

Conclusion

The articles we found in our review show that instruments developed for measuring MKT seem to pay little attention to separately measuring KCS and KCT, which raises the question why this is the case, and whether this is necessary. To measure SCK, KCS and KCT for teaching algebra of pre-service teachers in lower secondary education in the Netherlands, we need to combine items from different instruments and we need to extend this with items to measure KCS and KCT.

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