Combining two frameworks: A new perspective on mathematics teacher knowledge

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For many years, there has been an interest in the role of the teacher in mathematics education research. During this time, efforts have been made to conceptualize the professional knowledge required to be a mathematics teacher. However, yet no consensus has been reached on how to describe the knowledge and ability, which is special to mathematics teachers. One framework, "Mathematical Knowledge for Teaching" (MKT) (Ball, Thames & Phelps, 2008), developed in Michigan includes subject matter knowledge, pedagogical content knowledge and tasks of teaching, and is widely used, in praxis and theory. The Danish competency-based framework "Competencies and Mathematical Learning" (KOM) (Niss & Jensen, 2011), which is described in terms of possessing eight fields of mathematical competency and six competencies related to the teaching of mathematics, is less used. The frameworks have not yet been used together. This is what we propose to do using the framework for networking of theories as formulated by Bikner-Ahsbahs and Prediger (2010), which describes strategies for connecting theoretical frameworks.

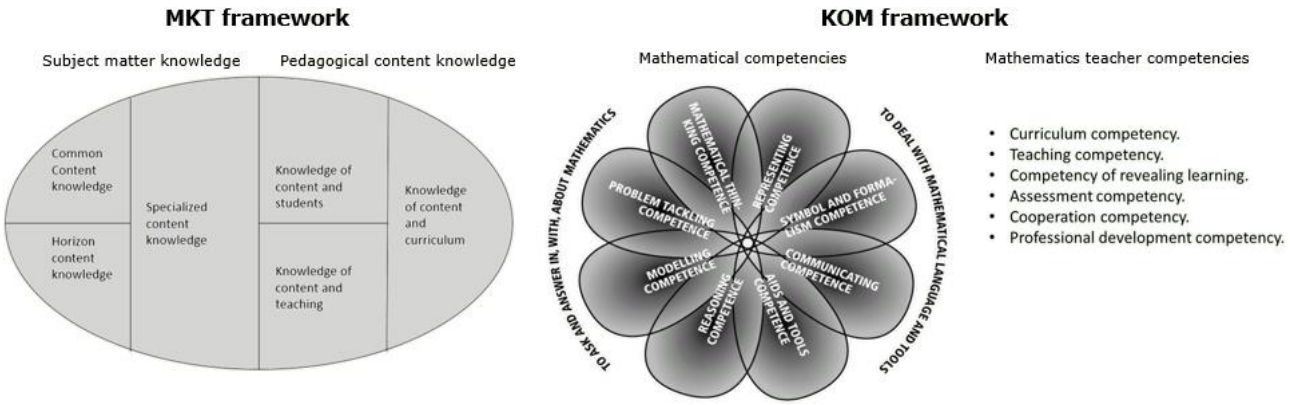

Figure 1: The MKT and KOM frameworks

Method

Based on a case study of the development of mathematics teacher knowledge among students in the Danish preservice mathematics teacher education program (Sloth & Højsted, 2016), which aims to qualify prospective teachers for work in primary and lower secondary schools, we investigate how and to what extent MKT and KOM can capture what the preservice teachers learn. Finally, referring to the model for networking of theories proposed by Bikner-Ahsbahs & Prediger (2010) we compare the two frameworks.

Results

We find that MKT and KOM can be used to describe most of our findings regarding the development of mathematical teacher knowledge in our case study, but the manner they describe them is different and do not always overlap. For example, when preservice teachers learn about different subtraction algorithms, which pupils might employ, we find the MKT framework can give a nuanced description of the unique mathematical knowledge and skills involved in teaching through its description of "Specialized content knowledge". The KOM framework does not address the issues of teaching at this level of detail, but one could say that the teaching of subtraction algorithms requires different mathematical competencies, like representation competency and symbol and formalism competency as well as teaching competency. Another example is when preservice teachers learn how to perform mathematical modelling and how to analyze the mathematical models of others. We find that KOM can capture this with modelling competency, whereas MKT lacks a way to describe mathematical processes like modelling, problem solving and reasoning skills. Meanwhile the details of the didactical aspects of the development of modelling competency are not elaborated in KOM. For example, typical difficulties pupils encounter when working with modelling are not described. This could call for the development of what corresponds to knowledge of content and students and specialized content knowledge, but with regards to competencies.

Conclusion

We conclude that MKT and KOM give different perspectives on mathematics teacher knowledge, that there are overlaps and differences when applied to practical situations, but also that the frameworks themselves may benefit from the perspective of each other. Using both frameworks on our case, we find that they can complement each other and describe a greater range of mathematics teacher knowledge. Furthermore, we suggest that using or combining concepts from both frameworks can result in a new understanding of the knowledge and ability needed by mathematics teachers.

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