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# Mathematical knowledge for teaching geometric proof: Learning from teachers' practices

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*The aim of mathematics education courses in both undergraduate and post graduate programmes in Malawi is to improve teacher's mathematical knowledge for teaching. Although the number of colleges and universities offering secondary mathematics education courses is increasing in Malawi, the quality of teaching has not improved to a greater extent (Government of Malawi, 2009). The capacity of the teachers to teach geometric proof in particular is still inadequate. The purpose of the study in progress, is to explore the knowledge that teachers require in order to teach geometric proof well in Malawian context. The initial findings of document analysis and the pilot study results will be presented in the poster.*

**Keywords:** Geometry, geometric proof, teacher knowledge, teacher education.

## THEORETICAL FRAMEWORK

Many studies have been conducted in different areas in reaction to Shulman (1986) notion of pedagogical content knowledge (PCK). Such studies aimed at developing content knowledge (CK) for specific subjects. In mathematics education, most of the studies aimed at developing models of mathematical knowledge for teaching (MKT) and developing instruments for measuring its domains (Ball, Thames, & Phelps, 2008). Professional Knowledge for Secondary School Mathematics Teachers (PKSSMT) is one of the recent models that build on Shulman's and Ball's models of teacher knowledge. PKSSMT was developed by Baumert and Kunter (2013) from the COACTIV project. It shares a common theoretical approach with Ball's mathematical knowledge for teaching (MKT) model, to the extent that its focus is on mathematical knowledge needed for understanding of instruction. Unlike MKT, PKSSMT regards CK as including secondary mathematics only. It views CK as a prerequi-

site for PCK. There are basically three categories of PKSSMT model which are CK, PCK and pedagogical/psychological knowledge (PPK). My research is guided by this model and it only concentrates on CK and PCK because PPK is mainly about individual and class management. In my view, PPK is common knowledge needed by every teacher hence not in the interest of this study. PCK emphasizes on three aspects; knowledge of cognitive activating tasks and their sequence, knowledge of student's cognitions and ways of assessing them, and knowledge of explanations and multiple representations. This shows that PCK mainly emphasise on tasks, student cognitions, representations and explanations (Baumert & Kunter, 2013). CK and PCK imply that research on the teaching of mathematics has to focus on teacher's conceptual understanding, tasks used for explaining and assessing teaching, how the teacher evaluate the tasks, and how the teacher explains and represent concepts to students. Based on this view, I developed these questions for my research; 1. How is secondary geometric proof conceptualised by the teachers? 2. What is the nature of the problems that are selected and used to enhance students' geometric thinking? 3. How do teachers interpret student productions/solutions of geometric proofs? 4. How are geometric proof concepts represented and explained to secondary school students?

## METHOD

Data collection is being done in phases. During the first phase which was a baseline survey, I analysed the Malawi National Examinations Board (MANEB) chief examiners mathematics reports of both junior and senior secondary school for the past five years (2008 to 2013). The reports show that students fail mathematics mainly due to poor performance in geometric proof questions. The chief examiners attribute students' poor performance in geometry to teachers' lack of knowledge to teach this particular

branch of mathematics. Students do not understand geometric proof because they are not taught properly how to construct and apply a proof. The Government of Malawi (2009) highlights that one of the challenges facing the education sector is limited human capacity and material resource. The challenge of limited human capacity is in both quantity and capability and is worse in mathematics and science. Challenges in terms of capability entail that teacher education is not equipping the pre-service teachers with proper skills that can enable them teach mathematics, in this case geometry proof, very well. That is why there is need to study MKT-geometry proof. The second phase of the study will use qualitative case studies on in-service teachers. Best and worst teachers will be involved in the study to ensure variety in data collection.

During the CERME9 conference, I will present the results of pilot findings which will be done using tests, individual interviews and lesson observations. The poster will be composed of the introduction, problem statement, conceptual framework, methodology, data analysis and results.

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