Improving the quality and capacity of mathematics teachers in Malawi: A collaborative project between the University of Malawi and the University of Stavanger

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In this chapter we discuss a project whose overall goal was to improve the quality of mathematics teaching and learning in Malawi schools. The project aimed to achieve this by improving the quality of mathematics teacher education since good teachers are key to quality teaching and learning. In designing activities to achieve its intended outcomes, the project expected the professionalisation of mathematics teacher educators to generate some degree of transformation in mathematics education in Malawi. A process of sociocultural transformation is necessary when aiming to improve the quality of teaching in a country such as Malawi where, in general, the quality of education is low and the quality of mathematics education, in particular, is poor. Since transformation involves changing norms and values as well as institutions and structures (Jha 2016), it is important to understand the social context and prevailing norms that need to be addressed. Although many societies could benefit from changing traditional modes of thinking and acting, some traditions remain beneficial and are important to retain. Thus, before we began designing or implementing any professional development programme for mathematics teacher educators,
our project set out to study and understand the mathematics education context in Malawi.

Since the early 2000s, three new concepts have influenced the field of mathematics teacher education. The first is mathematical knowledge for teaching (MKT) (Ball et al. 2008), which describes the different forms of knowledge that mathematics teachers need in order to teach effectively. The second is the mathematical discourse in instruction (MDI) framework (Adler and Rhonda 2017), which illustrates what constitutes a successful mathematics lesson in terms of students’ learning. The third is lesson study (LS) (Lewis and Hurd 2011), which is a way of studying teachers’ teaching and their own learning about their students’ learning. Our project aimed to introduce these three concepts into the field of mathematics teacher education in Malawi in such a way that they could be integrated with traditional ways of teaching and build on students’ existing knowledge. That is, we expected the process of change to be relative to Malawi’s own context. That is, we encouraged teachers to adopt these new ideas and related teaching methodologies to the extent they found them useful, and in ways that identified and retained the benefits of traditional knowledge.

Some background about Malawi

In 1994, free primary education for all was introduced in Malawi. While this was a big step forward for the country, it created many challenges for the education sector. Student enrolment in primary schools increased by 65 per cent in the first year – growing from 1.9 million students in 1994 to 2.9 million in 1995 – and almost doubled by 1996 (Kazima and Mussa 2011). This solved the problem of access to primary education for children but very few schools had enough facilities and teachers to handle this massive increase in enrolment. In an attempt to cope with the demand for additional teachers, the Malawian government employed many unqualified teachers and introduced fast-track teacher training for primary school teachers.

One consequence of this is that quality of teaching in general, and of mathematics teaching in particular, has fallen. This can be seen in achievement levels in mathematics at both primary and secondary
level, as evidenced from national examinations and international assessments. For example, in 2016, Malawi’s National Examinations Board reported pass rates of less than 50 per cent for the Malawi Schools Certificate of Education examinations for the previous ten years (MANEB 2016). Furthermore, evaluations (such as the Early Grade Mathematics Assessments and those carried out by the Southern and Eastern Africa Consortium for Educational Quality) have shown that primary school children in Malawi perform below the levels expected by the national curriculum (see Brombacher 2011; Hungi et al. 2010). Since a good knowledge of mathematics is crucial for social and economic development, these findings must be acknowledged and the factors leading to such low achievements must be addressed. As Kazima (2014) shows, one of the main factors contributing to this problem is the poor quality of teachers in primary schools.

With this background, our project was implemented with the overall goal of improving the quality of teaching and learning mathematics in Malawi’s schools through improving the quality of mathematics teacher education at the University of Malawi and at primary teacher education colleges. It was expected that by improving the quality of mathematics teacher education, the quality of teachers who graduate will also improve, and that this will, in turn, improve the quality of mathematics teaching and learning in schools in the long term.

The project and its achievements

The project was a collaborative effort between the University of Malawi and the University of Stavanger, and comprised a team of ten academic staff – six from the University of Malawi and four from the University of Stavanger. The project had five components, each with intended outcomes which together feed into the goal of improving the quality of mathematics teacher education. The five components were: a PhD programme, a master’s course, a professional development programme, research, and infrastructure development. In each one, at least one of the three key concepts (MKT, MDI and LS) was introduced. As described in more detail below, most of the project’s intended outcomes had been achieved by the end of 2018.
The PhD programme

Before the project, the University of Malawi offered a general PhD in education but had no PhD programme in mathematics education or the mathematical sciences. Our project designed and established one PhD programme specialising in mathematics education and another in mathematical sciences. When the project offered fellowships to University of Malawi staff, three staff members opted for the former and one chose the latter. Supervision of these students (two females and two males) started in 2014 and ended in 2018, and was carried out jointly between the two universities.

As part of the PhD in Mathematics Education, we developed a module on ‘Theories in the teaching and learning of mathematics’. This included readings and discussions related to mathematical knowledge for teaching. In addition, all PhD students focused their research and expanded their knowledge and abilities in relation to MKT. The topics selected by these three PhDs students are: i) An exploration of mathematical knowledge for teaching geometric proofs, ii) Investigating pre-service secondary school teachers’ mathematical knowledge for teaching equations, and iii) Assessing student teachers’ development of MKT through their initial primary teacher education. All three studies greatly informed the project, and by the end of 2018, two candidates had completed and graduated.

Having faculty members study MKT at PhD level has made them very knowledgeable about contemporary teacher education and of the importance of offering student teachers opportunities to develop all the forms of teacher knowledge necessary to teach mathematics effectively. This increased the number of staff at the University of Malawi with PhDs in Mathematics Education, thus enabling us to meet a key project objective.

The master’s course

Before the project started, the Faculty of Education at the University of Malawi ran a Master’s of Education programme that included some courses in mathematics and science education. However, to run a
specialised master’s programme in mathematics and science education, the faculty was required to create one additional course. Until our project was established, limited staff capacity had prevented this course from being offered.

Our project therefore soon developed a course on the history and pedagogy of mathematics suited to master’s students. Initially, the content was adapted from a course run by the University of Stavanger and was taught by the project team from that university. This made it possible for the University of Malawi to offer a new master’s programme focused on mathematics, which was a significant achievement. By 2018, a total of 23 candidates had been recruited for the degree in two cohorts. By the end of 2018, ten had successfully completed their studies.

In fact, we were aiming to recruit a total of 24 students in three cohorts. Since 23 had already been recruited in the first two cohorts, we exceeded this target when the third cohort of six students was recruited in September 2018. For this cohort, staff from the University of Stavanger and the University of Malawi jointly delivered the History and Pedagogy of Mathematics course. That is, PhD candidates who have graduated through the project are already helping to teach master’s students. This has ensured that the specialised master’s programme continues to be offered at the University of Malawi after project life. The fact that University of Malawi staff have completed their PhDs as part of the project, and begun teaching alongside experienced staff from the University of Stavanger, has been of great benefit to the University of Malawi and has helped to ensure that the project achieves its objective of increasing the capacity of the education faculty to offer specialised master’s programmes.

Professional development

Mathematics teacher education in Malawi is provided via two categories of institution; that is, teacher education colleges train primary school teachers and universities train secondary school teachers.

Our project designed and developed a professional development programme on the teaching of mathematics for primary school teacher
educators. The project worked with all eight public teacher education colleges for primary schools in Malawi and offered all mathematics teacher educators a professional development course. The course began in 2016 and was offered for three consecutive years.

The course began in May of each year, with a three-day workshop during which teacher educators were introduced to LS and MKT related to multiplication and fractions. Then the educators worked together to develop mathematics lesson plans for LS at their own colleges. After the workshops, and until November of each year, the educators conducted their own LS, recording the lessons and their discussions of these on video. Each November, the teacher educators attended a follow-up workshop where they reported back on the LS they conducted, and discussed what they had learned.

In addition, teacher educators were introduced to the MDI framework (see Adler and Rhonda 2017), and encouraged to use this to critically evaluate their lesson plans and textbooks. The MDI framework was developed in under-resourced mathematics classrooms in public schools in South Africa and helps teachers to identify what matters in a mathematics lesson regardless of the resources available in the classroom. Although the framework is applicable globally, we found it particularly relevant because Malawi schools are so under-resourced.

The topic of mathematical knowledge for teaching was also covered briefly during the November workshops. Like the students who enrolled for the PhD programme, the mathematics teacher educators involved in this development programme grew professionally. We expect that this professional growth to expand the skills levels of teacher educators as well as their values and ideas about teaching mathematics.

In terms of our aims, we hoped that at least 48 mathematics teacher educators would have completed the professional development course by 2018. In fact, we exceeded this number quite considerably. By the end of 2018, 89 mathematics teacher educators had completed the course. The skills acquired by teacher educators will stay with them long after the project ends, and we hope that many will share their skills with all the new teachers that they train, thus ensuring that our project has a lasting effect.
Research

Research is integrated into all project activities and can be divided into that carried out by our doctoral and master’s students and that conducted by the project team. The latter involved collaborative work across the two universities.

By late 2018, we had initiated 22 research studies on issues related to teaching and learning mathematics in both primary and secondary schools – three PhD dissertations, 15 master’s theses and four collaborative studies by members of the project team.

Our research findings have strongly informed the project and the mathematics education community in our universities. The research process has also improved the capacity of staff and students of the University of Malawi to design and carry out research linked to mathematics education. Research linked to teaching mathematics in Malawi had a great influence on the project. That is, studying and understanding our context was prioritised and this enabled us to apply modern teaching methods in ways that are appropriate to this context.

Infrastructure development

This component involved developing a mathematics room at the University of Malawi; that is, refurbishing an ordinary classroom into a room that is well-equipped for teaching and learning mathematics. Decisions made about what to include in the room were based on our research findings as well as the insights and experiences we gained from running the professional development programme. All of the teaching and learning materials developed for the mathematics room were made locally to ensure relevance and sustainability.

By the end of 2018, the room was completed and is now being used for teaching mathematics, mathematics education, and also for professional development courses for mathematics teachers. Locating this room at the University of Malawi is also helping to ensure that the project’s objectives continue to be met even though the project itself has ended.
Collaboration between North and South

As noted, the project was a collaboration between the University of Stavanger in Norway and the University of Malawi. Norway and Malawi are very different contexts with very different cultures. We were all aware of these differences as we conceptualised the project, and realised that developing some common understandings would be important in facilitating our ability to work together effectively. For example, Norwegian and Malawian colleagues had very different understandings of what constitutes a typical primary school mathematics classroom. This included every aspect from the number of students, the kinds of furniture, the resources available to the students and the teacher, to what teachers should do in a lesson.

For this reason, the entire Norwegian project team visited Malawi at the start of the project to experience the reality of Malawi’s schools, teacher education colleges, the University of Malawi and the general social context. This was very helpful when it came to planning and implementing project activities in Malawi. For the same reason, we revisited these institutions whenever Norwegian colleagues came to Malawi as this deepened their understanding of what is possible when it comes to the teaching and learning of mathematics here.

Similarly, we made sure that the project team in Malawi had an opportunity to understand the Norwegian context by visiting Norway and some Norwegian institutions. Recognising the differences between the Norwegian and Malawian contexts was useful to all project team members and helped us to appreciate each other’s views.

Our two countries have different cultures and systems related to schooling and university that shape our administrative and approval processes and impact on levels of efficiency. Since the project was based in Malawi, we relied more on Malawi’s systems and we could see how challenging it was for the Malawian team not only to perform effectively within the constraints of the system, but also to get the Norwegian team to understand those constraints. For example, procurement processes at the University of Malawi take so long that even though we anticipated delays, these took even longer than expected.
Similarly, obtaining approval for the new master’s course on the history and pedagogy of mathematics took much longer to be approved than we expected, and meant we had to postpone the recruitment of our first cohort of master’s students. At the beginning, the Malawian team struggled to explain these delays and the Norwegian team battled to understand the extent of the challenges. However, once the Norwegian colleagues became part of the faculty in Malawi and were helping to deliver the master’s course in Malawi, our awareness of each other’s cultures made the project team appreciate one another more.

In all, the collaboration worked well and quickly sparked another programme that has two components. The first component began in 2014. Since then, two Stavanger University students have visited Malawi for a month each year to conduct research for their master’s theses. Staff at the University of Malawi supervise them during this period. By late 2018, ten students had participated in this programme. While the focus is on mathematics education, fields such as special needs education are also covered. The second component involves student teachers from the University of Stavanger who can opt to do a four-week teaching practice in Malawian schools, supervised by the Department of Education and Sports Science at the University of Stavanger and the Department of Curriculum and Teaching Studies at the University of Malawi. By late 2018, six Norwegian student teachers had made use of this opportunity.

Although independent of our initial project, these additional collaborations have enriched it greatly. Research done by University of Stavanger students increased understandings of Malawi’s schooling system in general and its mathematics classrooms in particular. This was very useful for creating shared understandings between members of the project team.

**New versus traditional ways of teaching mathematics**

Traditionally, mathematics teachers in Malawi explain a concept and demonstrate how to use the concept to complete exercises. They then give students exercises to work out for themselves. This approach teaches children what to do and how, but not why. Consequently,
students learn procedures without understanding the mathematical reasoning for them or how they can be applied to practical problem-solving in the real world. Many students then memorise the procedures without engaging with the mathematical principles, and are unable to apply what they know in any meaningful way.

Our project sought to shift this traditional way of teaching and encouraged teachers to explain and justify the mathematical principles and skills that they teach. Furthermore, we encouraged teachers to create opportunities to discuss and explain to students how and why they do mathematics. When students are taught mathematics in ways that help them understand mathematical reasoning, they tend to find the subject more interesting, are more motivated to learn, they develop more skills and gain confidence in their own abilities. For teachers to be able to do this competently, they need a range of content knowledge and pedagogical skills.

Bringing the concepts of LS, MKT and MDI into mathematics teacher education in Malawi was interesting. On the one hand, the Malawi mathematics teacher educators could relate to these concepts and engage in discussions at levels expected of mathematics teacher educators anywhere in the world. This shows that, when the focus is on mathematics, and the teaching of mathematics, academic and professional skills are similar across different contexts. However, primary school teacher educators were accustomed to following a handbook that provides details of how to teach each topic. This handbook is a recommended text prepared and provided by the Malawian Ministry of Education. This made it challenging for teacher educators to put newly learned theories into practice and change their way of teaching.

The project was very aware of the need to help the teacher educators make the ‘transition’ from the traditional to new ways of teaching. The professional development course we offered included a workshop on evaluating mathematics textbooks using the MDI framework. Through hands-on activities, the teacher educators evaluated their own teaching materials, the handbook and other textbooks they use. This helped the teacher educators to see how they can apply MDI theory. Perhaps most importantly, it made teacher educators realise that following any text too systematically limits their thinking about possible examples,
activities and explanations that could encourage students to participate more fully in the lessons. The MDI framework encourages teacher educators to think about these elements in every lesson. Furthermore, inviting teacher educators from different colleges to engage in discussions with one another about their teaching provided an opportunity for them to learn from each other and share ideas about how to improve their practice.

The tradition of closely following recommended textbooks and teacher guides provided by the Malawi Ministry of Education is also prevalent in Malawi’s primary schools. Similar to the teacher educators’ handbooks, the teacher guides contain detailed suggestions on how to teach every topic, and provide examples and exercises for students. In this way, very traditional ways of teaching mathematics are encouraged and student teachers learn to emulate their own lecturers who also tend to follow these texts. However, as teacher educators learn to use these texts differently, student teachers will follow. Soon, neither student nor qualified teachers will see textbooks and teacher guides as prescriptive, but rather as tools that they can modify to suit their lessons and students.

We must note that Malawi’s education ministry does not dictate that handbooks and teacher guides must be systematically followed. However, the ministry has also not clearly indicated that suggested examples, tasks and activities are optional or open to modification. The professional development workshops we ran included participants from the education ministry’s department of teacher education, and we are hopeful that having these officials participate in discussions and evaluations of teaching materials will increase the chances of uptake of MDI ideas in official circles.

Having said this, attempts to change teaching practice in Malawi must be understood in the context of local schools where the average class size in primary schools is 88 students to one teacher. It is not uncommon for teachers to have over a hundred students in a class. Improving practice in such contexts requires careful reflection and the modification of teaching methods to suit the context. It is also important to consider which aspects of traditional teaching do work and to merge these with new alternatives. This is something that the project
team has taken into a subsequent Norhed project titled, ‘Strengthening numeracy in early years of primary education through the professional development of teachers in Malawi’.

In our view, three traditional methods still have some value in certain contexts. The first is that it is fine for under-and newly qualified teachers, who are not confident or able to design an effective lesson by themselves, to follow the handbooks and teacher guides. The second is the teaching of mathematics by demonstrating an example on the chalkboard and giving students exercises to work out using the example as demonstrated. This method remains effective in very large classes where space for teachers and students to move around in is very limited. The third is checking what students can or cannot do in order to evaluate the effectiveness of lessons. Although limited, this does allow for a quick assessment of each lesson and for follow-up action to be taken in the next lesson. Thus, given the current educational context in Malawi, completely replacing traditional teaching methods with ideas developed elsewhere could be unwise. Instead, this must be done slowly and with caution so as not to risk losing methods that do have some value.

**Situating the project in relation to the Sustainable Development Goals**

The project objectives were in line with the United Nations Sustainable Development Goals (SDGs), in particular SDGs 4, 5 and 17. SDG 4 aims to ‘ensure inclusive and equitable quality education and promote life-long learning opportunities for all’. Our project’s overall goal clearly supports this. Furthermore, the project reached all public teacher colleges which means it has made an impact on improving teaching in rural and urban schools, thus promoting inclusivity and equity.

SDG 5 aims to ‘achieve gender equality and empower all women and girls’. In Malawi, most mathematics teachers are male, so having good female mathematics teachers has real potential to encourage girls to study mathematics and follow mathematics-related careers. The project contributed to this by making sure that both genders were represented at different levels in the project. That is, the project team
included both male and female faculty members from both universities. In addition, the project recruited two male and two female PhD students, and the project encouraged female students to register for the master’s programme by offering eight scholarships to women. Our hope is that these female teachers will in turn encourage more girls in the schools where they teach to pursue mathematics.

Furthermore, while the professional development programme targeted all mathematics teacher educators across all eight teacher training colleges, regardless of gender, we realised that the colleges employ very few female mathematics staff. As noted, by the end of 2018, 89 teacher educators had completed the programme; only 17 of these were female. In response to the very low representation of women, the project held a meeting and workshop for all the female participants in the project with the aim of encouraging and empowering them within the male-dominated departments in their colleges. We hope that female mathematics teacher educators will continue to draw on this and support one another. Confident female teacher educators can be important role models for female student teachers who, we hope, will, in turn, encourage and empower girls in schools.

SDG 17 focuses on partnership and aims to ‘enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the sustainable development goals, including through North–South, South–South and triangular co-operation’. In the collaboration described here, the University of Malawi’s capacity to educate more teachers (and teacher educators) has increased.

In addition, the project ensured its own sustainability in several ways. The first was by ensuring that project activities and benefits could continue after the project ended. Four of the five components of the project, that is, the PhD programme, the master’s course, the mathematics room and various research initiatives that have been institutionalised by the University of Malawi will continue into the future. The second is that the capacity building that occurred among University of Malawi staff is enabling them to continue offering the master’s degree and supervising postgraduate students. Finally, in terms of the professional development programme aimed at mathematics teacher educators, our hope is that
sustainability is ensured in the sense that the teacher educators we trained acquired new knowledge and skills that they will continue to use in their ongoing teaching practice.

About the authors and the project

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Notes

1. See also the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ), in particular, the 2006 SACMEQ II Project Results regarding pupil achievement levels in reading and mathematics available at www.sacmeq.org

References


