

COLLABORATIVE WORKSHOPS FOR SUSTAINABLE TEACHER DEVELOPMENT

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The African Institute for Mathematical Sciences Schools Enrichment Centre (AIMSSEC) has developed well-trialled teacher workshops for groups of teachers to use independently in their local areas, complementing AIMSSEC's professional development courses for primary and secondary teachers, subject advisers, and field trainers. Workshops are freely available with a linked App, and target active learning with meaning-making, particularly in contexts which are low-resource and large-class. They are designed to further develop teachers' mathematics and mathematics pedagogy knowledge and feed directly into related lesson approaches, supporting improved rates of transition into mathematics and science careers for a range of learners. I draw on participant teacher interviews and written accounts to report on evidence of the use and impact of these workshops and related app in South Africa and beyond, their affordances and constraints, and ask whether this might provide a widely applicable and sustainable model for mathematics teacher development.

BACKGROUND: AIMSSEC MATHEMATICAL THINKING WORKSHOPS

AIMSSEC has for some years worked in South Africa to strengthen the professional knowledge of practising teachers of school mathematics in previously disadvantaged rural areas, whose students showed low transition rates into mathematics and science careers. This work has been successfully transferred to several other sub-Saharan countries. Although teaching is largely by expert volunteers, funding face to face elements has of course proved a challenge. AIMSSEC provides in-service courses focused on both subject knowledge and subject pedagogical knowledge at several levels: a 3-month Mathematical Thinking (MT) course, endorsed with 15 professional development points by South African authorities; a 2-year level 6 Advanced Certificate in Education (ACE) course and a 2-year level 7 Advanced Diploma in Education (ADE). Each of these features residential elements so teachers experience the approaches being advocated, but also sustained periods where teachers experiment with, reflect on and evaluate those approaches for their learners, supported at a distance by in-country or international mathematics education experts through online forums, individual support, and sometimes, end of year examinations. Courses therefore adhere to our best understanding of characteristics of effective professional development (e.g. Desimone, 2009).

They are designed for the many teachers who are mathematically under-qualified in international terms, and prepare them to be more effective teachers, heads of departments and subject advisers. A particular aspect of AIMSSEC residential courses is coverage of key ICT skills so that teachers are more confident to harness freely available resources and software to support teaching and learning, if they have access to the Internet. To date, AIMSSEC has trained nearly 2000 teachers on the MT short course, while 215 teachers have graduated from the two year ACE course.

A key feature of ACE courses in particular is that teachers are equipped, and encouraged, to take back to their local areas materials and approaches similar to those experienced, and use them in facilitating local self-help teacher workshops. A range of such workshops for lower secondary students is represented in a book (Hopkins et al, 2016), but importantly, professional resources for workshops at all levels are freely available at <https://aiminghigh.aimssec.ac.za/> or for any android smartphone the related free App can be downloaded from <https://www.appszoom.com/android-app/aimssec-aiming-high-bidgro.html> . Each workshop guide is aimed at groups of teachers working together, discussing approaches, deepening their understanding of the related mathematics, and engaging in strategies for active approaches to teaching and learning mathematics with meaning, often through problem-solving and guided re-invention. Guides use practical approaches to learning, and support development of a range of classroom communication – by teacher and learners, pointing too to further evidence-based reading. All the approaches have been iteratively developed through extensive trials with teachers in low-resource, large-class contexts. Each provides a summary of a mathematical topic, activities to work through with colleagues in a teacher workshop, lesson activities and suggestions for teaching, advice for implementing teaching strategies, and additional resources such as worksheets and templates. Importantly, by understanding why the suggested approaches work, and experiencing that for themselves, teachers are empowered to apply them to other areas of the curriculum.

STUDY

This paper draws on 6 short (250-350 word) unstructured accounts of teachers’ journeys with AIMSSEC: the total provided in response to an open call after one ACE course.

Teacher	Phase and current role	AIMSSEC background
T1	Lower secondary (grade 7-10), local leader of courses for 60 schools (2 groups)	MT, ACE
T2	Lower secondary (grade 7-10), local leader of courses using the MT book. Now Head of Department.	MT, ACE
T3	Lower secondary (grade 7-9). Now Headteacher	MT, ACE, teaching assistant, MT course tutor
T4	Upper Secondary (grade 10-12). Now working on national undergraduate mathematics scholarship scheme but still teaching in schools every week	MT, ACE
T5	Primary (grade 4-6)	MT, ACE, teaching assistant, MT course tutor
T6	Lower secondary (grade 7-9). After ACE, enrolled for BEd in Mathematics, then to a Masters in Mathematics Education: wants to move into teacher education	MT, ACE

Table 2: **Study participants**

These accounts were analysed via grounded thematic coding (Charmaz, 2006). Because the accounts were short, and written in English, I argue they represent key points in teachers' thinking about AIMSSEC. These fell into four categories, exemplified in every free response given: teachers' conceptions of mathematics, of teaching, wider impact of their experience on other teachers and on learners, and their affective responses.

The paper also captures the reflections of teacher 1 in a recent semi-structured interview which asked about perceived impact, and the role of face to face AIMSSEC sessions within that. Critically, it probed perceptions about the potential of the App to support significant teacher development along AIMSSEC-adopted principles, without any local facilitator attending a face to face AIMSSEC course. The teacher professional development literature is clear that experiencing the target approaches is important, as is expert support and challenge (e.g. Desimone, 2009), but the question remains, how effective is it to do so remotely, albeit if then embodied in structured teacher workshop activity and reflection – especially if such resources are not in teachers' home language?

FINDINGS AND DISCUSSION

Teachers conceptions of mathematics

Teachers' evaluations of MT courses almost universally show such change, for example, 'I discovered that mathematics is not only about numbers, it is a language in itself. Expressions and equations are a short way of narrating a story, they are not just numbers and symbols without meaning' (Hopkins et al 2016, p204). However, the responses of these ACE graduates were striking:

I experienced a "mathematics-culture-shock", as the course exposed my shallow understanding of mathematical concepts...This course changed my life. For the first time, I discovered that mathematical concepts can be taught as objects. I reflected on my teaching and realized I had not been doing justice to the learners, and neither had my schoolteachers to me. Apart from using teacher-centred approaches and forcing learning to stick to formulae, I was indirectly excluding learners from learning and enjoying mathematics (T4)

I shared the strategies I learnt at AIMSSEC with teachers from the two circuits. I always pointed out that, "Mathematics is not about formulae; it is about relating concepts for better understanding." (T1)

Teachers conceptions of mathematics teaching

Teachers referred to changes in the ways they thought about teaching mathematics: 'it was a wonderful journey of exploring and learning how to teach mathematics... we were always actively involved in the learning process' (T6); 'it helped me to understand different teaching methods I could use in my classroom to make the learners understand mathematics better' (T2); The (MT) ten days changed my outlook and teaching approach and opened my eyes to many new experiences (T5).

Wider impact of teachers' experience on other teachers and on learners

Teachers talked largely about impact on other teachers, but sometimes pointed to specific impact on learners: '(I) share the knowledge I have gained with other teachers in my school for application in the different learning areas' (T2);

My colleagues were amazed these workshops changed our approach to teaching and to mathematics. Instructions were simple, clear, understandable and straightforward. They were thought-provoking and challenging to people's creativity – and learners enjoy them and learn with understanding... if AIMSSEC

had the chance to teach in our schools, every learner would be passing mathematics: many more of our students are. (T4)

The skills I have gained will continue to make a difference... within and outside my school and community. Since my involvement with AIMSSEC, our mathematics pass results have increased by 25%: learners are achieving that with understanding and choosing to study more mathematics. (T3)

The skills I learnt from the AIMSSEC courses boosted my confidence in presenting workshops for educators and I began ... mentoring sessions in my district, piloting with 2 circuits, each with 30 schools, and I also conducted Grade 9 Spring School for the pilot circuits. (T1)

AIMSSEC teaching strategies have inspired me to further my studies in mathematics and to encourage capacity development of fellow South Africans. I am continually broadening my horizons and this encourages me to add value in mathematics education in my province, the country and in Africa as a continent. (T1)

Teacher 1 was able to articulate a sequence of impacts she had observed in her district, from herself to other teachers to learners, citing observations of classrooms ‘where teachers and learners are more confident and engaged, learners want to discuss the meaning of what they are doing, can justify that and support one another in thinking mathematically’. She also pointed to improved examination results and greater interest and success in pursuing mathematics-dependent study further.

Teachers’ affective responses

Teachers talked of a new interest, commitment and enthusiasm - but also of empowerment that follows from greater understanding of the mathematics and of teaching and learning: ‘I can empower teachers who in turn will go back to their respective schools and empower thousands of learners in mathematics’ (T6); ‘I became more interested in teaching the subject’ (T2);

I returned (from MT) ..., a “new” teacher, one who turned mathematics lessons into joyful learning sessions. The ACE course was another extremely enjoyable and deeply engaging course. In addition to the enriching content... It made me want to give of my very best; proving, once again, what an amazing impact a motivated teacher can have ...I think that teachers need to learn and teach more than just content alone. They need to teach hope and bring joy to the classroom. That comes with confidence and genuine self-enjoyment. (T5)

Teacher 1 talked about the ‘excitement of learning and doing mathematics together in new ways’, but also of a need for confidence to lead that. She had used the App to access additional workshops but was doubtful an App standing alone could endow that confidence – or the in-depth understanding of why workshops were so constructed. Research is needed to find out how much expert-supported face to face contact is needed to support valid local enactment of workshops – or whether such support could perhaps be effective remotely, but e.g. live online: such considerations are key to affordable and sustainable effective development of teachers of mathematics in Africa and elsewhere.

References

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