Vol.5 Special Issue No.2 (2022)

Journal of Applied Learning & Teaching

ISSN : 2591-801X

Content Available at : http://journals.sfu.ca/jalt/index.php/jalt/index

Improving teaching and learning mathematics in Malawi primary schools: a review of reforms, interventions, successes and challenges

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Keywords

Intervention;
Malawi;
primary mathematics;
reform;
teaching and learning.

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Article Info

Received 14 November 2021
Received in revised form 6 June 2022
Accepted 8 July 2022
Available online 11 August 2022

DOI: https://doi.org/10.37074/jalt.2022.5.S2.3

Abstract

Teaching and learning mathematics in Malawi primary schools has been of concern for many years. This is because of the low learner achievement in national assessments by the Malawi National Examinations Board, where learners' performance in mathematics at end of primary education has been consistently low. In other assessments, such as the Early Grade Mathematics Assessment (Brombacher, 2011) and the numeracy assessment by the Southern and Eastern Africa Consortium for Monitoring Education Quality (SACMEQ, 2011), the average performance of Malawi learners has been below the expectation of the curriculum. In an attempt to address the issues and improve the quality of teaching and learning of mathematics, there have been curriculum reforms which revised the content objective based curriculum to learner outcome based curriculum and aimed at shifting teaching from traditional teacher centred to more learner centred teaching approaches (Ministry of Education, 2007). In addition, over the years there have been interventions in the teaching and learning of mathematics; some interventions targeted mathematics teachers in schools to implement new teaching strategies, while other interventions targeted entire schools and communities. In this paper, we review the reforms and interventions, analyse their successes and challenges, and discuss the implications for improving the teaching and learning mathematics in Malawi primary schools.

1. Introduction

Mathematics is a compulsory subject in Malawi primary and secondary schools. In primary school, mathematics is one of three subjects (the others are English and Chichewa) that is taught every school day. In the first four years (Standards 1 to 4), teaching is in Chichewa or another local language, while from Standard 5 onwards, teaching is in English. Despite the emphasis on mathematics in schools, the learners' achievement continues to be a concern (Brombacher 2019; Ravishanker, 2016). We begin this paper by presenting the problem of learner underachievement in mathematics in Malawi primary schools. Then we give the context by an overview of the Malawi school system and the primary school teacher education. In the rest of the paper, we discuss the reforms and interventions in Malawi that aimed at addressing the problem of primary school learner underachievement. Finally we discuss the implications of theses for improving teaching and learning mathematics in Malawi primary schools.

Primary school mathematics learner achievement

Many studies have revealed that many learners in Malawi achieve below the expectation of the Malawi primary school mathematics curriculum. For instance, the 2008 Primary Achievement Sample Survey for learners in Standard 2 and Standard 7 reported a pass rate of not more than 20%, whereas the 2012 Monitoring Learning Achievement survey reported that 49% of Standard 2 learners, 23% of Standard 4 learners and 59% of Standard 7 learners performed below the expected minimum achievement (Ravishankar et al., 2016). The 2010 Early Grade Mathematics Assessment (EGMA) also revealed poor performance of learners below the expectation of the curriculum (Brombacher, 2011). The EGMS study found that nearly 56% of the 500 participating Standard 2 learners could not perform basic addition of single-digit numbers with a sum of less than 10, which is a curriculum expectation at the end of Standard 1. A more recent Malawi Longitudinal School Survey found that Standard 4 learners scored an average of only 50% for Standard 1 test items and 33% for Standard 4 items (Brombacher, 2019). Similar findings were reported in earlier assessment studies such as the 2006 PCAR Standard 1 Baseline Study, the 2005 study on Monitoring Learner Achievement in Lower Primary School, as well as the 2008 study on Assessing Learner Achievement in Standards 2 and 5 (Maganga et al., 2009).

Internationally, Malawi has participated in large scale assessments by the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ), which assess the achievement of Standard 6 level learners. In all the assessments, SACMEQ I in 1995, SACMEQ II in 2000, and SACMEQ III in 2007, Malawi ranked at the bottom as one of two least performing countries in mathematics. The majority of the standard 6 learners were classified as reaching only the lower level competencies of emergent numeracy and basic numeracy, but not the higher competences of mathematically skilled, concrete problem solving and abstract problem solving (Milner et al., 2011).

Brombacher (2019) attributes the much reported learner underachievement in mathematics to the nature of teaching mathematics in Malawi primary schools. He gives the example that even though the number of digits for carrying out addition and subtraction increases as the learners move to the upper classes, the procedure remains the same of single-digit arithmetic that is carried out using counters and the "combine and count all" strategy. Furthermore, the teaching focuses on rote learning and not on understanding, reasoning and application. As such, learners fail to apply their understanding when they face assessment items in a format that is not familiar to them. Other factors that contribute to the low achievements are large class sizes; lack of teaching and learning resources such as text books and exercise books; and problems of learning mathematics in English while not competent in the language (Kazima, 2008, 2014).

The Malawi school system

In Malawi, formal school has eight years of primary and four years of secondary education. The primary school is classified into three sections; infant (Standards 1-2), junior (Standards 3-4) and senior (Standards 5-8). The primary education is free and easily accessible. At the end of primary school, learners sit for the national Primary School Leaving Certificate Examinations, which learners have to pass before admission to secondary schools. Secondary education is not free but the fee is heavily subsidised by the government. The secondary schools are not as easily accessible as primary school. There are many more learners than available space in secondary schools. Learners are selected to national, conventional, or community day secondary schools based on their performance in the national examinations. The secondary education runs for four years, from Form 1 to Form 4. At the end of Form 4, learners sit for the Malawi School Certificate of Education Examinations, which is a national examination used for selection into Universities, teacher education colleges or other institutions.

Malawi primary teacher education

Malawi primary school teacher education is carried out in Teacher Training Colleges (TTCs) for a duration of two years and the qualification obtained in a teacher certificate. As of 2020, Malawi had eight public primary TTCs and eight private TTCs (Ministry of Education, 2020). All the TTCs follow the same curriculum and programme. The teacher education programme prepares generalist teachers such that after completion, the teachers are expected to teach all school subjects and across all classes. There is no specialisation in terms of subjects or level.

The primary teacher education programme in Malawi has gone through changes over the years. Before free primary education was introduced in 1994, the teacher education programme was for three years. In 1994, free primary education was introduced and resulted in huge increase in student enrolment in schools. The three-year teacher education programme was stopped and replaced by the two-year Malawi Integrated In-Service Teacher Education

Programme (MIITEP). This was a crash programme to fast-track training of about 22,000 unqualified teachers who were recruited to address the shortage that was created by an abrupt 51 per cent surge in primary school enrolment (Kunje et al., 2003). MIITEP was on the job training in a blended-mode programme with 4 months of face to face courses at TTCs and 20 months of school-based training in form of teaching practice. MIITEP was discontinued in 2005 after concerns about the quality of the teachers being poor. In 2006, a two-year Initial Primary Teacher Education (IPTE) programme was developed in response to the Primary Curriculum and Assessment Reform (Ministry of Education, 2020). The original IPTE started with one year of college-based courses followed by one year of teaching practice. The programme also had a Distance Learning mode for on-the-job training of unqualified teachers. In 2016, the IPTE programme was reviewed and the structure was revised to start with two terms of college-based taught courses, followed by two terms of teaching practice in schools, and finally another two terms of college-based taught courses, where at the end student teachers sit for their final certification examinations. The distance mode was discontinued and recruitment of unqualified teachers was stopped. Despite the aforementioned changes in teacher education, issues of learner underachievement in mathematics still persist.

2. Review of primary curriculum reform

From content-based to outcome-based curriculum

Prior to 2001, primary schools in Malawi had a content-based curriculum which was first established in 1961 during the colonial era and was continued after independence in 1964 (Ministry of Education, 2019). Although there were curriculum reviews in 1982 and 1991 with the aim of improving the quality of education and to align the curriculum with the social, economic and environmental needs of an independent Malawi (Chirwa & Naidoo, 2014), the curriculum remained content-based. The content-based curriculum was characterised by teacher-centred methodologies where teachers mostly focused on covering the content. In the 1982 curriculum, mathematics was called Arithmetic and emphasised on learners' acquisition of number knowledge and computational skills with speed and accuracy. The curriculum was revised in 1991 following weaknesses that were observed, in particular that it offered too many subjects of study and that it was examination-oriented (Chirwa & Naidoo, 2014; Saka, 2019). The revised curriculum focused on literacy and numeracy. In numeracy, the subject was no longer called Arithmetic but Mathematics, because the subject was meant to develop learners' mathematical capabilities that would help them solve problems in their everyday lives (Malawi Institute of Education, 1991). The curriculum included problem-solving and discovery learning approaches to teaching mathematics. However, it remained a content-based curriculum.

In 2001, another curriculum review started with the main aim of shifting from a content-based to an outcome-based curriculum. The outcome-based curriculum, which is the current curriculum, was designed with a focus on learner achievement; what learners should be able to do at the end of a learning cycle. Two of the key features of an outcome-based curriculum are learner-centred teaching methods and continuous assessment (Chirwa & Naidoo, 2014). In this curriculum, Mathematics has six core-elements which are (i) number operations and relationships; (ii) patterns, functions and algebra; (iii) space and shape; (iv) measurement; (v) data handling and (vi) accounting and business studies. The core element of number operations and relationships takes up to more than 50% of the mathematics time. The expectation of this outcome-based curriculum is that within the first two years, learners should be able to count and perform basic mathematical operations (Ministry of Education, 2004). It is surprising, however, that over a decade from the implementation of the outcome-based curriculum, learners still face difficulties in performing basic mathematical operations such as addition and subtraction (Brombacher, 2019; NSO, 2021), and the problem of learner underachievement persists.

From teacher-centred to learner-centred teaching

Implementation of the outcome-based curriculum started in 2008 through the Primary Curriculum and Assessment Reform (Ministry of Education, 2019). The requirements of this new curriculum called for a major shift from the traditional teacher-centred teaching to learner-centred teaching. This shift involves the use of pedagogical practices that move the focus from the teacher and instruction to the learner and learning (Schuh, 2004). Studies have shown that if well-implemented, a learner-centred approach to teaching and learning promotes active participation among learners and enhances learning (Vavrus et al., 2011). It is now more than a decade since the implementation of the outcome-based curriculum and the associated learner-centred approach. However, success in terms of improving learner performance in mathematics has not yet been registered. Studies that have investigated this reveal that although many teachers are aware of the learner-centred approaches and acknowledge the need to use learner-centred approaches in their lessons, they have challenges with how to use the approaches in their teaching.

Sometimes teachers think they are using learner-centred approaches while in reality they are not (Longwe, 2016; Mizrachi et al., 2010). This implies that teachers have theoretical knowledge about learner-centred teaching, but putting it into practice is a challenge. The second challenge is that teachers perceive learner-centred approaches as too involving and time-consuming during both lesson preparation and delivery (Chiphiko & Shawa, 2014). The third challenge is large class sizes, which make facilitation of meaningful learner participation difficult (Chiphiko & Shawa, 2014; Mtika & Gates, 2010). In Malawi, it is common to have classes of more than 100 learners against one teacher (Brombacher, 2011). As Mtika and Gates (2010) argue, the implementation of learner-centred teaching approaches works well in classes with a reasonable number of learners because teachers can easily manage to provide individual support. The challenges faced in the implementation of learner-centred approaches tend to force teachers to revert to the use of teacher-centred approaches (Chiphiko & Shawa, 2014), and this might explain why learners still

continue to perform below the expected achievement level in Mathematics. The concern in mathematics achievement has led to a number of interventions, which we discuss in the next section.

3. Review of interventions

Large scale and long term interventions

The Numeracy Boost intervention

The Numeracy Boost intervention started in 2012 with support from Save the Children. It was introduced in selected rural schools in one district. The initiative was motivated by the low achievement of Malawian learners in mathematics in comparison to that of learners from other countries in the region (Milner et al., 2011) and early years' learner performance that is below Malawian curriculum benchmarks (Brombacher, 2011). The Numeracy Boost intervention has three components: community camps, capacity building and learner assessment.

Community camps

Numeracy camps are the core feature of the Numeracy Boost intervention. The camps are placed in communities surrounding intervention schools, and operate after school in a non-structured play-like environment. They are run by camp facilitators who are volunteers from the communities. The camp facilitators are coordinated by qualified school teachers, termed camp supervisors, and they act as a link between the community and the school. The camp supervisor suggests focus areas of mathematics content for a specific period based on coverage of mathematics in school (Mbendera, 2019).

Capacity building

The Numeracy Boost intervention provides short training to volunteer camp facilitators and teacher camp supervisors. The intervention also provided training for mathematics teacher educators at primary teacher training colleges, and these were involved in developing teaching and learning materials for the camp, as well as training the camp facilitators and supervisors (Mbendera, 2019).

Learner assessment

The Numeracy Boost intervention has three content focus areas: (i) number concepts and operations, (ii) geometry and (iii) measurement, which are considered universal conceptual areas that are taught to learners during the early years of primary school. Thus, the initiative deals with topics such as counting and place value, addition and subtraction, shape identification and composition, and understanding units and tools of measurement. In the communities where the Numeracy Boost initiative is implemented, each academic year begins with a baseline diagnostic assessment and ends with an end-line assessment and report. The baseline assessment is used to identify learning gaps in the focus areas, hence informs the structuring of the interventions during the academic year. The assessment is also offered to control schools for comparison (Mbendera, 2019).

Successes of the intervention include that it provides a structure in which the community is positively involved in their children's learning of mathematics. This has led the learners and communities to develop a positive attitude towards mathematics (Save the Children, 2018). Another success is that learners have another site of learning mathematics. Some teachers utilise the numeracy camps for complementing work not thoroughly covered in the classroom. Training of teachers as camp supervisors offers teachers the skills and knowledge of operating mathematics camps and interacting with the community and discussing mathematics informally.

However, the intervention also faces some challenges: firstly, the volunteer camp facilitators lack support from camp supervisors (Mbendera, 2019), probably because the camp supervisors are teachers with busy workloads and do not have much time for the camps. Secondly, the running of the camps depends on the availability of volunteer facilitators and some camps do not take place as often as desired, which is twice a week. Thirdly, there are no permanent meeting structures, such that the numeracy camps are often conducted at open spaces prone to environmental conditions such as rain. Finally, some consider the meeting times of twice a week inadequate to address the learning gaps among the children (Mbendera, 2019).

The Unlocking Talent project

The Unlocking Talent (UT) through Technology is an international project aimed at improving numeracy and literacy for marginalised early years learners worldwide (Pitchford, 2018). This project uses tablets to deliver learning instructions to learners in the early years of primary school. The tablets are loaded with learner-centred apps that are developed based on the primary school curriculum content of the country in which they are used (Pitchford, 2018).

In Malawi, the UT project is funded by the Norwegian Embassy and implemented in partnership with the Voluntary Services Oversees, the Malawi Ministry of Education, Onebillion, DFID, UNICEF and the Scottish Government (Royal Norwegian Embassy, 2017). The project was introduced in Malawi to address the continued reports and concerns about the low level of primary school learners' attainment in mathematics, which were reported by the different assessment studies discussed earlier. Key factors that were attributed to this problem of learner underachievement include lack of textbooks and other teaching and learning resources; overcrowding in classrooms and the quality of teaching. In order to overcome these challenges, the UT was created as an intervention focused on basic numeracy skills, without relying heavily on the quality of teachers (Hubber et al., 2016).

Implementation of the first phase of the UT project was launched in 2014 and the second phase was launched in 2018. The project is being implemented in more than one hundred primary schools throughout the country, targeting early years learners. Each of these participating schools gets equipped with about 30 tablets preloaded with Onebillion apps. Each school has a purpose-built learning centre within the school campus, where the intervention takes place (Pitchford et al., 2019). During the school hours, 29 learners at a time are pulled out of their regular classes to use the tablets in the learning centre. The learners learn mathematics individually using the apps loaded into the tablets. The app has sound and each tablet is connected to a headphone so that each learner focuses on his or her own activities without being distracted by noise from the others. All the apps are in Chichewa, which is the national language of Malawi. The tablets are designed in a way that they are easy for the learners to use, and the learning centre teacher acts only as a facilitator. The teacher registers the learners on the tablets, monitors learners' progress and solves technical problems. The app gives feedback to the learner as they work through the mathematical activities (Pitchford et al., 2019).

The UT intervention has registered some successes towards the learning of mathematics in the early years of primary school. In a randomised study conducted by Pitchford (2015), it was revealed that the intervention helps to support learners' development of early numeracy skills. One of the reasons for the success is that the interactive features of the apps enable learners to progress through the mathematics content at their own pace, and it allows learners to repeat activities when needed (Outhwaite et al., 2017). Another success story from this intervention is that it promotes inclusivity in terms of gender and special education needs (Pitchford, 2019). The UT intervention has been observed to be an effective way of equalising learning opportunities for both boys and girls, thus helping to narrow the gender gap that exists in mathematics attainment between girls and boys in primary schools, in favour of boys. Furthermore, positive impacts and learning gains have also been registered on learners with some special educational needs (Pitchford et al., 2018). However, learners with hearing impairment made slow progress through the apps compared to their peers because the apps use verbal instructions, and this limits their ability to learn (Pitchford, 2019).

There are some challenges that the UT intervention faces. These include that it does not include learners with hearing impairments. Another challenge is that the intervention is implemented in only about one hundred schools countrywide (Pitchford et al., 2019), out of more than five thousand. Therefore, it reaches only a small proportion of the primary school learners in Malawi. Finally, pulling learners out of their regular classes to use the tablets does not seem to be a good strategy because the learners miss other lessons while attending the UT sessions.

Small scale and short term interventions

Improving the quality and capacity of mathematics teacher education in Malawi

A collaboration between the University of Malawi and the University of Stavanger, Norway, led to a five-year project from 2014 to 2018. The overall goal was to improve mathematics education in schools through improving the quality of teachers. The project focused on enhancing the capacity of mathematics teacher education. A professional development programme was developed by the project and offered to all mathematics teacher educators in all public primary teacher education colleges. The project was funded by the Norwegian Agency for Development Cooperation (NORAD) through the Norwegian Programme for Capacity Building in Higher Education and Research for Development (NORHED). The project worked with two or three teacher colleges each year and offered the professional development programme to all mathematics teacher educators at the colleges. The programme started with a three-day workshop, followed by lesson study activities in the colleges, then ended with another three-day workshop (Kazima & Jakobsen, 2019).

The success of the project is that it reached all eight public primary teacher colleges and enhanced the teacher educators' capacity to offer improved quality mathematics teacher education courses in their colleges. It thus improved the quality of teachers they prepare. Another success was the creation of networks across the colleges which was facilitated by the mathematics teacher educators from different colleges meeting and working together during the professional development workshops. The networks have continued after the project and continued to promote good quality mathematics teacher education. A challenge for the project was that during the lesson study activities in the colleges, the professional development facilitators worked with the mathematics teacher educators remotely through emails. A study on the professional development established that more support by physically visiting the colleges might have been more effective (Fauskanger et al., 2020).

Strengthening numeracy in the early years of primary education through professional development of teachers project

This is an ongoing five-year collaborative project between the University of Malawi and the University of Stavanger running from 2017 to 2022. The project aims to improve the teaching and learning of numeracy in the first four years of primary school and is also funded by NORAD through NORHED. The target is rural schools which are the most disadvantaged in Malawi (Kazima & Jakobsen, 2019). The project offers professional development to teachers of standards 1-4. The duration is seven months; it starts with a three-day workshop which covers counting, early number concepts, and an introduction to lesson study. This is followed by lesson study in schools with the support of the project team. It ends with another three-day workshop where the lesson study is reflected upon and further plans are made. The second workshop also covers the mathematics teaching

framework (Adler & Ronda, 2015) and more number concepts (Kazima & Jakobsen, 2021).

The success of the project includes that it has enhanced the teachers' capacity in teaching mathematics in the early years. Through the lesson study, the teachers have developed their skills in reflecting on their teaching and working together to improve their mathematics teaching. Challenges are that in many rural schools there are large classes of more than 100 learners to one teacher, and lesson study in such large classes can be challenging. Conducting lesson study is time consuming and it takes time for teachers to see the benefits of working together within the schools. The project is relatively small and reaches only a small proportion of the rural schools.

JICA Numeracy project

This intervention was carried out in 2016 to help learners progress from unit counting to composition and decomposition – for example, to be able to recognise 7 + 5 as (7 + 3) + 2 and obtain the answer, 12. The intervention involved three weeks of training for Standard 1 to 3 teachers from two pilot schools. A pre-test was administered to a sample of 21 Standard 2 learners and 21 Standard 3 learners who were observed doing unit counting with their fingers. This was followed by the intervention of teaching the learners using patterns of composition and decomposition, then a post-test. It was observed that the learners were able to work out the problems without unit counting during the post-test, suggesting that they were able to progress to composition and decomposition strategies of addition and subtraction.

4. Discussion

The reforms and interventions were developed and implemented to address the concerns of low achievement in primary school mathematics as revealed by the various assessments discussed earlier. The goal is to improve the teaching and learning of mathematics in schools and consequently improve learner achievement. Each of the reforms and interventions contributes to this common goal. The curriculum reform was for the whole school curriculum and therefore was a more general approach. The shift from content-based to outcome-based curriculum was aimed at focusing on the desired outcomes in terms of learning rather than focusing on content in terms of teaching. Thus, learner-centred teaching was emphasised to achieve the desired outcomes. The reform was a good move because the benefits of learner-centred teaching over teacher-centred teaching in mathematics are well documented (Ganyaupfu, 2013; InWent, 2009). The question that arises is why then has the reform not succeeded in resolving the problem of low achievement in mathematics? Research has shown that the success of learner-centred teaching is compromised because the shift was not supported by the relevant conditions of reduced class size, learner-centred textbooks, and teacher support. Another important factor is the schools' focus on national examinations which lead to examination-oriented teaching. The national examinations are high stake because good performance secures space in the highly competitive secondary school admission. Therefore, it is not surprising that schools focus on passing the examinations and not necessarily understanding.

The two examples of large-scale interventions also contribute to the common goal of improving learners' learning and achievement. They both aim to support learners in their learning of mathematics. The Numeracy Boost focuses on the community and relies on volunteers and children attending the camps outside school hours. The benefit of involving the community is that the children are supported in their learning by their community and the children, as well as the community developing a positive attitude towards mathematics. A positive attitude toward mathematics leads to a productive disposition which is an important strand in becoming proficient in mathematics (Kilpatrick et al., 2001). This intervention is possible to scale up to other schools because it has minimal costs; the costs are only in terms of the training of the volunteer camp facilitators, and the teacher camp supervisors. However, there is a need for evaluation so that the benefits and strengths are retained and the weaknesses are addressed, for example enhancing the capacity of the volunteers by strengthening their training and support.

The Unlocking Talent intervention focuses on the individual learners during school hours and it relies on teachers. The app on the tablets enables learners to learn and progress through the activities at their own pace. Thus, it offers the benefit of experiencing individual learning that is not reliant on others. Such learning enhances learners' confidence and a positive attitude towards mathematics, thus contributing to their development of productive disposition (Kilpatrick et al., 2001) in mathematics. This intervention has registered successes in improving learners' achievement in mathematics and has shown to be effective in inclusiveness. The evaluation of learners within the intervention has shown that individual learning using tablets reduces inequalities among boys and girls, and learners with special educational needs. Although this is clearly a desired outcome for Malawi, scaling up the intervention is not realistic because of the costs, and is not sustainable after the intervention project life. In the intervention schools, they have only 30 tablets against hundreds of children, such that learners take turns to use the tablets during school hours. While using the apps is proving beneficial to the learners, the consequences of missing other lessons should not be underestimated. It might have been better to have the tablet time outside the school hours, although that would have its own challenges, such as the need for additional teachers' time.

The small scale interventions also have the same common goal of improving learning and achievement in school mathematics. The focus is different for each; the first NORHED project focused on mathematics teacher educators, the second on teachers, and the JICA project focused on learners. The focus on teacher education was good because it recognises that teacher education and in particular mathematics teacher educators play a big role in mathematics teaching and learning in schools. Therefore, enhancing the capacity and quality of the teacher educators enhances the quality of mathematics teacher education and

the teachers produced. The project already scaled up to all public teacher colleges in the country. It is possible to sustain the lesson study in the teacher colleges and continue to improve the mathematics teacher education in the colleges and hence the quality of mathematics teachers produced. However, this is more of a long-term solution and therefore the need for other more immediate solutions.

The second NORHED project which focuses on teachers is one such more immediate solution. An evaluation within the project has shown that teachers find the professional development activities useful; it enhances their capacity to reflect on their teaching and pay attention to their learners' learning (Kazima & Jakobsen, 2021). This intervention is possible to scale up and sustain because the project uses existing government structures of schools, zones and districts which will continue to operate after project life instead of introducing project structures which end with the project. However, there might be challenges in terms of the costs of offering the workshops to teachers and having enough competent personnel to facilitate the workshops and support the teachers in the lesson study in schools.

The small-scale JICA intervention focused on learners in schools and one specific strategy for addition and subtraction. Teachers were involved and offered training on how to teach the strategy to learners. The intervention contributes to the common goal of improving the learning of mathematics because it demonstrates that the strategy works, and learners are able to progress from the counting all strategy to more mathematically efficient strategies. This intervention is possible to scale up. However, since it is only one strategy, it might not be economical to scale up on its own. It would be more cost effective to have it as one of many other strategies for various operations offered as professional development of mathematics teachers.

5. Conclusion

In this paper, we have presented the persistent problem of primary school learner underachievement in mathematics in Malawi, as registered by both national and international assessments, and we have reviewed the reforms and interventions aimed at addressing this low achievement. From the review and discussion, it can be seen that improving the teaching and learning of mathematics involves many stakeholders, including teachers, learners, teacher educators, schools, and the community. All of these play a part in developing the learners' interest in, and learning of mathematics. While it might not be possible for one intervention to focus on all these, being mindful of the roles the other stakeholders play can make a difference. There have been successes and challenges for all the interventions. It is important to draw from the successes to move forward and also learn from the challenges. It is also important to recognise the strengths of the teachers in Malawi. For example, they have skills of teaching in large classes, teaching with limited resources, and the skill of making their own teaching and learning aids from locally available materials. In most cases, teachers are enthusiastic to teach mathematics and learn through professional development. Making the most of these strengths would strengthen the teaching and learning of mathematics and have a positive impact on learner achievement. Although it is not practical to scale up and sustain some of the interventions, they reveal what is possible to achieve and can guide the conceptualisation of more realistic interventions that can be implemented and scaled up. The small-scale interventions also inform what is possible and can form a basis for larger-scale interventions. The interventions targeting learners have shown that learners in Malawi have the ability and potential for high achievement in mathematics. It is therefore important to find ways of addressing all the factors that limit learners' achievement and continue working towards effective teaching and learning of mathematics in Malawi schools.

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