

Remediating Secondary School Mathematics in Sierra Leone

The Winning Teams Pilot

INFORMATION BRIEF



What was the problem?

In Sierra Leone, secondary school pupils typically have levels of mathematical competence far below the levels intended by the school curriculum. The further through their school career pupils proceed, the greater the gap between the expected level of skills and knowledge in mathematics and the levels attained. This picture is supported by evidence of the Secondary Grade Learning Assessment, curriculum coverage analysis of teachers' lesson reports conducted by Leh Wi Lan, pupil assessment results, and more widely.

The Learning and School Safety Study (LASS) 2022 noted that among a nationally representative sample of Junior Secondary School level 3 (JSS3) pupils, only 4% had competency levels in mathematics expected at their school level, while 57% did not have mathematics competency above Primary School level. Among Senior Secondary School level 3 pupils, no pupils demonstrated Senior Secondary School level competency in mathematics (even at SSS1 level), while 59% had Junior secondary level and 42% had Primary School level competency (rounded figures) ¹.

The problem is compounded by mutually-reinforcing shortcomings in the teaching and learning process: many teachers lack sufficient subject competence and training to teach the mathematics syllabus; teaching methods are largely 'chalk and talk'; many pupils in class are not actively engaged in learning mathematics; pupils fear mathematics, do not enjoy the subject and lack confidence in their ability to tackle it.

Additionally, neither the time spent learning mathematics in class, nor the teaching and learning materials used in regular teaching, give pupils sufficient practice tackling and solving mathematical problems in each topic area to master the skills and conceptual content. Immediate, useful, formative feedback to enable pupils to identify and understand where they have made mistakes or have misunderstood, and then follow-up help to overcome these hurdles, are largely absent from the typical mathematics classroom.

The result is that pupils under-achieve in mathematics at school and this impacts negatively on their ability to succeed in other subjects and to fulfil their potential in life or in further study after school.

What was the solution?

Winning Teams

From 2019 to 2023, the UK Aid-funded Leh Wi Lan ('Let's learn!') project supported Sierra Leone's Ministry of Basic and Senior Secondary Education (MBSSE) to pilot a remedial Mathematics learning activity, using 'Winning Teams', a method and materials developed and supplied by a South African organisation, Winning teams (Pty) Ltd. In the Sierra Leone pilot, this was used as an after-school activity, typically for one hour, two to three days per week in term time.

The Winning Teams model was based on a rolling process of:

- Pupils learning collaboratively in study groups, supported by a facilitator
- Regular use of a board game where teams compete against one another to answer quiz questions based on the mathematics curriculum topics they have been preparing.

In this model, the game serves as focus and motivation, stimulus for peer-supported learning, and a means of formative assessment of learning, providing immediate feedback to the pupils and to the facilitator. This informs pupils, facilitators, class teachers and education managers where more attention is needed with a topic. Pupils take on roles as team captains and players, referee/question setter, and time-keeper/'lines-person' to record the session and support the referee.

The underlying principles of Winning Teams are to make the learners active, and to foster peer-supported learning, as distinct from teacher-centred learning. The methodology is designed to nurture in learners a sense of competition and fun, for motivation and engagement, and also a sense of achievement and confidence in their ability to learn.

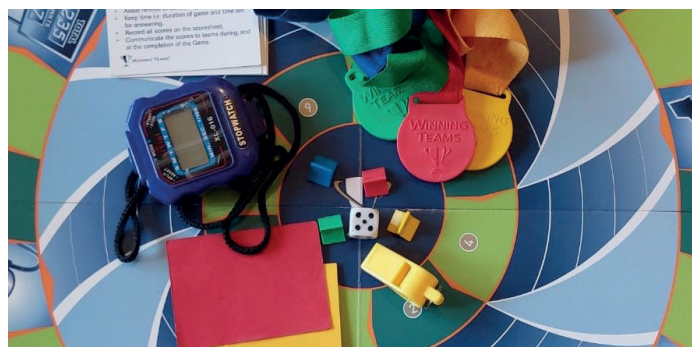
Remediation through revisiting the previous year's syllabus

To address the problem of gaps in previous years' learning, the Winning Teams pilot focused on bolstering mastery of the syllabus for the year below the grade the pupils were currently in. The alignment of related topics from one grade to the next was documented in summary topic alignment guides and in detailed topic concept charts. The Winning Teams learning sessions and the questions set for the game were focused on these topics, in line with the sequence of corresponding topics through which the regular class teacher was scheduled to be progressing with the class during the year. For example, Junior Secondary School (JSS) year 2 pupils worked on topics based on JSS1 syllabus content.

The Winning Teams materials

Winning Teams prepared questions and answers for the game, and topic guides and tuition support materials for the facilitators, specifically for the Sierra Leone school syllabus and context, drawing on MBSSE's Pupil Handbooks and teacher Lesson Plan Manuals for the content and activities.

The generic board game kit included a board, dice, counters to move around the board, colour-coded medals on lanyards for team captains to wear while they are playing, time-keeper's whistle and stop-clock.



Winning Teams set of game materials.

There were also record-keeping materials including score sheets, attendance record sheets and bi-weekly summary report forms for the facilitator to fill-out and submit to central administration with observations on progress and any issues.

How was it introduced in Sierra Leone?

Winning Teams was piloted in three districts in Sierra Leone. The activity was introduced initially for pupils at Senior Secondary 2 level, in 20 schools, for approximately 2,800 pupils. The focus then shifted to supporting Junior Secondary 2 level pupils, in 10 schools (about 1,800 pupils), and continued the next year supporting the same cohort when they progressed to Junior Secondary 3 level.

The final cohort supported through the project was JSS1 pupils, revising Primary 6 level learning content. The schools involved in this iteration comprised the 10 Junior Secondary schools already experienced in running the activity, along with an additional 10 schools, each of which was paired with one of the experienced schools, in a 'buddy' peer-to-peer support arrangement. In these 20 schools, approximately 2,500 JSS1 pupils took part, more than half of whom were girls.

For the Senior Secondary level, facilitators were sought from the community. In practice, trained Mathematics teachers were engaged as 'Community Facilitators'. For the JSS implementation, a different approach was adopted: school leavers who had completed Senior Secondary 3 level and who were currently available in the local community were recruited as facilitators ('Maths Captains').

National consultants, supported remotely by Winning Teams in South Africa and in-country by Leh Wi Lan management and administration, trained both cadres of facilitators and provided follow-on support and monitoring.

What was the outcome?

To assess the effect of the Winning Teams pilot, a survey was carried out in 2021, to gather the views of stakeholders who had been directly involved². Data was gathered through individual interviews and focus group discussions. Those consulted included participating pupils, facilitators, mathematics teachers, heads of department and principals of schools, community representatives, parents and education officials. Monitoring visits and regular reporting from schools each term also provided information. These were followed by pupil assessment tests administered at the start and end of the most recent two terms, comparing changes in performance between schools that participated in Winning Teams and schools that did not. The following key benefits to pupils' learning emerged.

Increased learning, with improved test scores

Engaging in the remedial mathematics Winning Teams activity improved learning. In the start-of-term and end-of-term tests administered in the second and third terms for JSS3 pupils, there was marked overall improvement in the scores achieved in the schools engaged in Winning Teams compared to the schools which did not have the remedial mathematics activity. The schools in which the remedial activity was not used improved in some cases only marginally, and in other cases quite well, after a term's classroom teaching.

The spread of scores across topics suggested that the same parts of the curriculum were found difficult by pupils in all schools. This may be due to a range of factors: the way these topics have been taught in mainstream classes; teachers' unease with the topics; the topics being timetabled late in the term so classes were unable to study them at all or at least in any depth because of lack of time.

The changes in scores associated with the remedial Winning Teams activity between the start and the end of each term are also likely to be a combination of various factors, including the benefit of the remedial support available from facilitators and fellow pupils; the practice afforded by the additional learning tasks available and used in the remedial activity; and feedback to the mainstream class teachers arising from the remedial sessions and Winning Teams game scores, leading to the teachers focusing effort on revisiting those parts of the syllabus where pupils found difficulty.

Active learning

Winning Teams promoted active learning. Using the remedial process and materials provided a significant increase in opportunities for activity-based learning. Pupils learned together, helping one another to solve problems. Pupils reported finding this engaging as an activity.

"I learnt group discussion and engagement to solve a Maths problem, which is not happening in class. The winning Team's methodology was also learnt which is different from a normal classroom session."

Girl pupil

"I learned to work in a group to solve Maths problems and, during the game, I got direct feedback from the community facilitators. This improved my timing in dealing with Maths compared to in the class lessons, as during class the time is short."

Boy pupil

Identified gaps in classroom learning and provided practice

Winning Teams enabled learners and those supporting their learning to see where there were gaps in pupils' understanding, and then to address those areas. Pupils and facilitators gained immediate assessment feedback on where learning remained to be achieved, through playing the game. The cycle of learning, testing and feedback reflected short and specific chunks of learning. The questions in the game reflected the carefully structured and sequenced coaching materials and activities. The materials and activities were in turn linked to specific parts of the preceding year's curriculum and what the pupils were expected to learn in class.

This picture was shared with the mainstream class mathematics teachers. Teachers, for their part, alerted facilitators to areas where pupils had difficulty in class. The information obtained helped facilitators to focus further coaching support, and pupils to focus their practise.

"I have properly understood my topics like charts, graphs etc. These were difficult for me to understand in the Maths lesson because our normal class time is not enough for teachers to pay attention to all of us."

Boy pupil

"Fractions it's a topic not well taught in my normal class lesson but I grabbed the concept during the remedial class."

Girl pupil

Built confidence and reduced fear of Mathematics

Winning Teams helped participants to become more confident in Mathematics. 80% of surveyed participants said that engaging in Winning Teams and playing the game as part of the process helped pupils with learning Mathematics content a lot. In a similar vein, 91% of surveyed pupils said it built their confidence in Mathematics a lot.

Both boys and girls gained confidence in mathematics. This was noted consistently by pupils and also by facilitators, teachers, parents, education officials and others.

"Winning Teams helps me to have confidence in dealing with Maths, compared to being in class. Also, helped me to learn new techniques for answering questions, especially in areas not covered in class."

Girl pupil

"It is very important to enhance pupils' ability in Maths. Pupils did not see Maths as a monster but rather as a game to be enjoyed. 'Maths is fun'."

Community Facilitator

"The games have helped our pupils to be confident, and their performance in Maths class has improved. There has also been increased interest in the subject compared to the period when the games were not available in school."

Parents focus group discussion

Girls and less confident learners participate more equitably

Girls and less confident learners were encouraged and able to participate in the learning activities.

Pupils, facilitators and parents concurred strongly in observing that Winning Teams built learners' confidence in mathematics. Although girls faced more challenges than boys to attend out-of-class sessions, largely due to domestic chores, girls did attend, participated fully, and were positive about the remedial sessions.

Both male and female participants felt they had equal or greater chance to take leading roles in the game than their peers of the opposite sex. Facilitators, whose training had included care to be gender responsive and ensuring girls had equal opportunities in the sessions, felt girls had greater or equal involvement in leading in the game.

"In the Winning Teams class there was inclusion: everyone was allowed to participate, and the game played was interesting. This was absent during Maths lessons."

Girl pupil

Valued by learners, teachers and school community

Winning Teams was widely valued by those involved. Pupils, facilitators, Mathematics teachers heads of Mathematics departments, school principals, community school management committees and District level education officials were all positive about the benefits of the remedial Mathematics activity.

"Winning Teams has ensured pupils like Maths, and it has increased their curiosity, instinct for competition and for fun. It has also increased their spirit of participation and the joy of winning."

District level education official

"I must say the programme has significantly improved the Maths liking in the targeted level of students as they are falling in love with the game and Maths."

District level official

As well as benefitting the pupils, various of the JSS3 school graduates serving as facilitators (Maths Captains) commented that they found the role beneficial to themselves, in strengthening their own Mathematics confidence or in preparing them for examinations or applying for further studies, including aspirations to enter careers in accounting, medicine, nursing or education.

"At the beginning, I was scared of teaching the brilliant students in the remediation class but I'm very confident now."

Maths Captain - Facilitator

"I want to pursue a career to be a mathematician after learning a lot from the programme."

Maths Captain - Facilitator



A team captain reads out their answer to a question set in the game.

Key recommendations to take forward

Increase learning outside the school timetable, based at school

Additional mathematics learning activities beyond the main timetable should be encouraged and supported where feasible. This should be on condition that these are not simply extra lessons, and are not a commercial tuition add-on. They should use effective, learner-centred methods and materials, provide extensive additional practice and exposure to mathematics problems, revisit earlier years' curriculum, develop individual and group learning skills and confidence, and make learning fun and enjoyable.

Efforts should at the same time continue to strengthen the quality and effectiveness of mainstream classroom teaching, through preservice and in-service teacher development and other means. However, timetabled lesson time is inadequately helping pupils to learn the Mathematics expected.

Wherever possible, schools should be used as the base for such remedial learning among school pupils. The school typically remains the established focal point and organisational hub for learning. Even for out-of-class learning, the school offers the most appropriate physical facilities, and accountability, management and administrative structures, and is the locus of academic and professional expertise in the community. The role of the class teacher remains key. Remedial activities should complement and support mainstream classroom teaching (assuming this is available), and be closely linked to it.

Support local community members as resource to support learning

Winning Teams and other remedial mathematics initiatives should draw on available and willing capacity in the community. The responsibility for organising and staffing such activities lies at school and community level, with partnerships locally being essential to their success. These should be carried out with the endorsement of MBSSE at national and District levels, so that MBSSE can request its staff to allow and collaborate and support these initiatives. Support should include training in the remedial activity methods, opportunities to consolidate academic content, materials needed to deliver the remedial activity, peer and community of practice networks, as well as engagement of school management and leadership and the parent community.

The task of developing the quality and effectiveness of Mathematics teaching in mainstream classes is essential and is at the heart of making an effective school education system. However, closing the learning gap through the established mainstream classes will take considerable time to achieve, and in the meantime cohorts of children are passing through the school system and leaving without a basic grounding in mathematics.

The national secondary school curriculum for Mathematics is undergoing change, with the Junior Secondary School level developed and the Senior Secondary School curriculum having undergone draft revision, to be fully developed and rolled out. Whilst these changes are expected to improve Mathematics teaching and learning, the beneficial effect will take time to work through the system, as with teacher development.

Use team games as a tool for learning

Introducing and encouraging the use of games as a familiar element of learning should be pursued. The Winning Teams game, and other game-based learning, can enhance learning in mainstream lessons as well as in remedial out-of-class sessions. This applies at secondary level and indeed with adult learners, as much as it does at primary school level and with younger learners. Use of games adds a motivational element, enjoyment and focus. Team competition adds collaborative learning. The rationale and techniques of using Winning Teams and other materials and methods should be included in preservice and in-service teacher training, to make teaching and learning more effective.

Use of the approach, including its focus on remedial, peer-supported learning as well as playing the game competitively within schools, need not be to the detriment of time available for teaching the curriculum of the current year. It can be incorporated into teachers' lesson planning or added on as an extra after-class session, according to the preferences and capacity of the school management.

Develop a demand-led partnership approach

A partnership model should be established which is based on an agreement between government and local communities. This should include an element of community demand and commitment. The community should take some responsibility for managing and supporting the activity, with contributions in kind. This is essential for the innovation to be sustainable beyond the duration and scope of initial development and piloting under the temporary support of a project. By making the innovation sustainable more widely and over a longer duration, a greater benefit can be gained from the development effort. This can contribute to the learning of large numbers of pupils in the school system.

In the case of Winning Teams, a teacher from one of the initially-supported Senior Secondary schools decided to continue and expand the activity after project funding ended. His school not only continued using the Winning Teams approach with its own pupils for remedial coaching of Mathematics, but also developed question cards for different grade levels and expanded to implement the activity in nearby Junior Secondary and Primary schools.

This expansion was based on the commitment and motivation of the teacher, and the school, community, parents and pupils recognising the benefit of the remedial activity to pupils' learning. Furthermore, as a result of the local stakeholders seeing the learning benefits to be gained, demand was created which led to the game being introduced for coaching science.

Assessment results in Mathematics have underpinned this horizontal spread of acceptance and enthusiasm: in the area where this continuation has taken place, pupils in the schools which have engaged in the remedial activity have been reported to show increased attainment in Mathematics compared to those which have not done so.

For example, pass rates in the public West African Senior Secondary Certificate Examinations (WASSCE) for Mathematics improved from 60% to over 90% in one school when Winning Teams was introduced. Though it may be assumed there are other contributing factors to this change, it is notable that, before Winning Teams was introduced, only one girl from the school passed the public WASSCE Mathematics exam. In 2022, of the cohort who had engaged in Winning Teams, all 186 girls passed (Hassan Turay, Alikalia Ahmadiyya SSS). The schools which had participated in Winning Teams also showed greater levels of improvement in examination performance, and comparison of pre- and post-testing, than broadly similar schools which had not.

The teacher who has led and sustained this expansion, Hassan Turay, has acted as an advocate and resource person at events, visited and lobbied local schools and community management groups, and built a regular profile at local, district and national levels on social media, sharing learning ideas, images and news of groups engaged in Winning Teams. Schools and parents have bought into the idea, and pupils have sought to join the activity. This process has been with the blessing of Leh Wi Lan and of the MBSSE and Teaching Service Commission (TSC) in the district, and

achieved without any financial assistance. Wider advocacy and exposure and demonstration of this success offers a path towards a sustainable model. At the closing event for Leh Wi Lan, in March 2023, Hassan Turay presented the approach, his experience, and his current work-in-progress localised adaptation, using locally made and available board game materials, which he considers a sustainable way forward for schools without recourse to external funding. At the conference, Hassan was introduced to the Minister of Education, David Sengeh.



Pupils from Junior Secondary School participating in the Winning Teams game.

The inputs from government in a longer-term and wider government-community partnership to support this activity might most usefully comprise funding for the purchase and supply of the initial game board kits and training material, and incorporating professional oversight of this activity into the work of the School Quality Assurance Officers as part of their routine support to schools. Peer-to-peer support among schools, sharing experience, advice, materials and motivation, might also be part of a school cluster-based community of learning approach to school continuous quality development. An inter-school Winning Teams competition was held in Moyamba District, which was found motivational. This might become a termly or annual event.

Find the Winning Teams Facilitation Materials here:
<https://mbsseknowledgeplatform.gov.sl/material/winning-teams-facilitation-materials-2/>

¹ Learning and School Safety (LASS) Study 2022, Briefing note 1: Status of pupil learning outcomes in junior and senior secondary schools two years on from school closures in Sierra Leone. MBSSE (Leh Wi Lan), March 2023. Available, along with other LASS reports, on the MBSSE Knowledge Platform: <https://mbsseknowledgeplatform.gov.sl>

² Winning Teams – Lessons learned. Mathematics remediation

This Information Brief was produced under Leh Wi Lan, a six-year programme that supports the Ministry of Basic and Senior Secondary Education (MBSSE) to improve learning outcomes for boys and girls at secondary school and to increase enrolment, retention and wellbeing of girls and children with disabilities.

Leh Wi Lan is managed by Cambridge Education and funded by UK aid from the UK government. For more information visit

<https://mbsseknowledgeplatform.gov.sl/> or <https://mbsse.gov.sl/leh-wi-lan>.