

SHARING LESSONS

from the field

Girls'
Education
Challenge



QUARTERLY NEWSLETTER

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Making it count: Mathematics in the Girls' Education Challenge

This quarter's newsletter looks at the teaching of mathematics in the Girls' Education Challenge (GEC). The achievement of literacy and numeracy targets are a core measurement of the success of GEC projects. At midline, the results were mixed but, in general, literacy targets were more consistently met than those for numeracy. This analysis was borne out by the Evaluation Manager's (EM) midline findings.

The reasons for this are still being explored and are likely to be different for each project and context – and the issues are not all exclusive to the education of girls. Nonetheless, qualitative feedback and the historic experience of teaching mathematics to girls in many countries across the globe (e.g. *Towards Gender Equity in Mathematics Education*, ed. Gila Hanna, 2002) suggests that there are a number of shared challenges and obstacles and a variety of interventions and approaches that have shown success.

This paper is based on feedback from a number of GEC projects. It outlines the shared (and individual) challenges, including the perception of mathematics as a 'hard' topic, teachers' skills and other obstacles in and outside of the classroom. It also highlights a number of the approaches being implemented that are showing signs of success and reflections on additional/future interventions that might enable sustained change and success in the teaching of mathematics.

The terms mathematics and numeracy are both used within this document.

We have distinguished between the teaching of mathematics (the broad subject covering concepts in number, algebra, shape and space and data) and the numeracy skills (the ability to use mathematics in everyday life) that learners gain.

There are few studies on this issue in the public domain at the moment. We hope that this paper stimulates further discussion and that additional contributions can be made by GEC projects, particularly through analysis of the endline reports later this year.



Context

The issue of raising the achievement of girls in mathematics is not new. In England, the gap between girls' and boys' achievement in mathematics was highlighted in a 1982 government report by Wilfred Cockcroft, who found that girls were getting lower grades in public examinations and fewer girls were continuing to study mathematics in further and higher education. Over the next two decades there were some small but dramatic gains, which came in particular from simple changes in teaching mathematics. (*Mathematics Counts*, WH Cockcroft, 1982).

The GEC midline results and direct feedback from projects suggest that this is an issue in many of their classrooms. The lower results in numeracy (as compared with literacy) are not always limited to girls but as the GEC is focused on raising these standards, it is clearly valuable to explore the challenges, as they relate to all learners, and identify those which are exclusive to girls. Tackling these obstacles benefits all learners.

“In schools where good practice exists neither sex is favoured at the expense of the other. Indeed focussing on the means of providing girls with opportunities of learning mathematics in congenial and appropriate conditions will help to ensure that all pupils will be able to reach their potential as individuals.”

Girls Learning Mathematics, Her Majesty's Inspectorate, 1989

To date, there are very few studies which look specifically at the teaching of mathematics to girls in developing countries but the issue has been explored, most notably in the 2014 Report 'Teaching Numeracy in Pre-School and Early Grades in Low Income Countries', published by GIZ, the German Development Agency.

This report concludes that “The development of early numeracy programmes cannot be successful if we use the ‘one size fits all’ approach (Meaney et al., 2013). Specific groups of students have their own needs and point to particular types of intervention to meet them. In particular, this study deals with the special issues that arise in the context of teaching numeracy to children from high poverty backgrounds, children from indigenous backgrounds and children from non-dominant language groups. Likewise, the participation and achievement of girls in education remains a problem in many countries and calls for specific policies and intervention programmes.”

Why is mathematics important?

Poor performance in mathematics in primary and secondary schools is seen as a significant barrier to improved economic and social outcomes both at the level of the individual and of the nation.

A large body of evidence shows that mathematics education in Sub-Saharan Africa is in a precarious state. The learning deficit between countries in the region and international norms is so large that, without extensive and sustained interventions across all phases of education, the gap may never be narrowed let alone closed (Beatty and Pritchett, 2012).

Recent research was commissioned by the World Bank in response to a growing recognition that countries in Sub-Saharan Africa will need to boost performance in the Science, Technology, Engineering and Mathematics (STEM) subjects if they are to realise their full potential in a competitive global market increasingly shaped by the use of new technologies (*Mathematics Education in Sub-Saharan Africa: Status, Challenges, and Opportunities*, George Bethell, June 2016).

This report concluded that there was no 'magic bullet' and that “any solution will require simultaneous actions on many fronts”. It also concluded that “special attention should be paid to changing the view that mathematics is predominantly a subject for boys. Schools, institutions of further and higher education, and potential employers should reinforce the message that careers in STEM-related fields offer valuable opportunities to all regardless of gender. Highlighting good female role models, using gender-appropriate learning materials, and adopting interactive teaching methods will help to improve the confidence (i.e. self-efficacy) of girls in mathematics and, hence, their achievement.”

GEC midline results

GEC midline results from the Step Change and Innovation projects indicate that their interventions have so far improved learning outcomes for 689,854 girls, against the midline target of 629,200. Combined literacy and numeracy learning impact results clearly vary by project. **However, at this point, literacy outcomes appear to be greater than numeracy outcomes.** On average, the projects have achieved 95% of their literacy target and 79% of their numeracy target.



“Projects have not been able to improve numeracy to the same extent as they were able to for literacy. At the window level, the EM data shows no evidence of a positive effect on the average numeracy of girls in treatment communities compared to control communities. Similar to literacy, numeracy improved significantly for out-of-school girls by 13 percentage points since baseline compared to the control group according to the EM data.”

GEC Midline Evaluation Report Step Change Window, Coffey (Evaluation Manager), February 2017



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Challenges

GEC projects were asked to highlight what they had learned, at baseline and through the delivery of their interventions, about accelerating numeracy outcomes for girls and, in particular, the challenges that they have encountered in delivering strategies to improve the teaching of mathematics. They highlighted a number of similar issues, particularly those related to the perception of mathematics and the way it is often taught.

Negative perception of mathematics

There is a perception by children, and girls in particular, that mathematics is a 'hard' subject. This is often perpetuated by parents (and even teachers) who themselves were not taught mathematics well (or sometimes at all) and believe it to be beyond their capability. This perception leads to a negative attitude towards the subject and a lack of enthusiasm. Importantly, it also affects confidence in the subject and leads many students to disengage at a very early stage.

Teachers and teaching

Projects cite low teacher ability in mathematics as another obstacle to successful teaching. High teacher turnover and a low ratio of teachers to students (sometimes 1:70) are also common issues. Teacher training in the subject can be difficult where there is a lack of resources and training time. Many teachers are not sufficiently computer literate to make use of ICT tools and programmes (where available) which can reach a greater number of students and make mathematics simpler and more accessible.

There is evidence from projects that some teachers have a preconception that girls are 'less able to do mathematics' than their male peers and this affects girls' performance. Also this can lead teachers not to ask girls to answer questions in mathematics so as not to 'humiliate' them in class. This further compounds girls' confidence in achieving in mathematics. A lack of female mathematics teachers is seen as a serious barrier to changing the perception that girls have the ability to understand and succeed in the subject.

In Tanzania, mathematics is optional in national exams, which can reduce the incentive for girls (and boys) to study the subject.

In the classroom

Low and irregular school attendance make consistent teaching and the reinforcement of techniques difficult. Resources such as text books and mathematics supplies (e.g. rulers and protractors) are often limited and expensive. Children are often unfamiliar with (and scared of) the 'language' of mathematics and a theoretical curriculum can make the concepts difficult to grasp.

Catching up

Although many projects use remedial classes to help girls 'catch up', they can sometimes be difficult to introduce. After school classes can be tiring for learners, particularly if they are underfed. They can also clash with household responsibilities and, where parents are not convinced of their value, they can be deprioritised.

The approaches

In response to these challenges the GEC projects have introduced a number of strategies which are outlined below. As the recent World Bank report concluded, there is no one solution to addressing lower achievement in numeracy. However, it is clear from anecdotal reports on the strategies that appear to be making some progress (there will more evidence at endline), raising standards in mathematics is mostly about what happens in the classroom – the teacher's approach to the students and the way mathematics is taught.

The teacher

Most projects advocate a participatory classroom environment with an approachable teacher who does not use punishment or embarrassment as a tool. Small tests or quizzes can be used to successfully embed concepts, with recognition of success (and perhaps small prizes) used to reward achievement. Teachers are also trained in methods that actively encourage the participation of girls. Often, only the most confident children will raise their hand to answer a question in class. Strategies to include less-confident children include:

- Asking all students write their answers on a piece of paper and show their answer at the same time.
- Asking students to discuss their answer first with a partner.
- Posing open rather than closed questions so that there are lots of possible answers.

“The Education Development Trust recognises teachers as key implementers of the Wasichana Wote Wasome (WWW– Let All Girls Read) project. Therefore, they provide regular training and teacher coaching to build their capacity. I have managed to attend several teacher trainings and coaching which have indeed added value to my teaching. I would say that teachers’ trainings have had a positive impact on me as a teacher in terms of enhancing my capacity and skills; and changing my attitude towards girls’ ability to learning mathematics.”

Benjamin Mogeni, a teacher at Kaitese Primary School in Turkana County, Kenya

The lesson

Projects also stress the importance of the way in which mathematics is taught. Almost all feedback includes the value of using real-life, practical examples to teach mathematics. Making the subject relevant to the children’s lives (and their families) immediately makes theory and concepts more valuable. Related to this, many children can be successful in solving ‘word problems’ but find getting to an answer much more difficult when it is written in numbers and operators. They also encourage the use of culturally appropriate examples. Introducing fun, interactive and visual tools also helps to breakdown the ‘fear’ of mathematics as a ‘difficult’ subject.

Linked to the practical teaching of mathematics, teaching financial literacy has emerged as a core element of a number of interventions.

HPA and Teach a Man to Fish (Rwanda) established an “Education that Pays for Itself” model in target schools. They introduced business skills to schools by teaching students how to run their own profit-making, student-led businesses. Parent-Teacher Associations (PTAs) and School Management Committee members have also benefited from the business training. This activity has been associated with an improvement in numeracy, a perceived relevance of schooling as being important for employment-related skills, and is part of HPA’s (Rwanda) sustainability strategy.

CASE STUDY

I Choose – Africa Life, Jielimishe GEC Project, Kenya

Susan’s story

“My name is Susan. I am a Class 8 learner at a primary school in Laikipia West Sub-County. I am an orphan and I face many difficulties in my education. I have been playing the role of a mother to my family since my mother died when I was in Class 4. Part of my responsibility is to look for casual jobs during my free time and weekends to make money to help in buying food and other needs for my brothers and sisters. In addition to my family situation made concentrating in learning hard, other difficulties at school added to my lack of concentration in learning especially mathematics. For example, teachers were too fast in teaching and it was hard for me to follow what they were explaining. I knew that mathematics was hard and I also got no encouragement because most of the girls did not like mathematics and did poorly in the subject. I had very limited time to do extra school work after school hours because of my family responsibilities at home.”



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Susan said that she started improving in mathematics and overall in other subjects when Jielimishe project started in their school. She reported that:

- After training, teachers became friendly and more approachable to the learners. Learners were able to ask teachers questions without fear and learners could access teachers when they needed to make any decisions concerning their lives. In addition, teachers were interested to talk to learners about other problems at home that could be affecting their school work.
- Teachers also started teaching mathematics using a lot of activities which made learning mathematics fun and less difficult; and she slowly started developing interest in learning mathematics.
- Some ‘fun’ mathematics activities were introduced within the clubs which encouraged Susan and other pupils to be more active members and to learn more about mathematic concepts with their peers during club time.
- Teachers organised mentorship and exchange visits which enabled girls/students to meet other girls/learners who liked mathematics.

As a result of Jielimishe strategies mentioned above, Susan’s overall performance in class work including mathematics improved. For example, in the third term of Class 7, at the end of 2016, Susan came fifth overall in her class, and in the first term of Class 8, this year, she came third in the midterm examinations. Her marks in mathematics and science have continued to improve steadily.

On the whole, Susan has become very motivated and is one of the best performing girls in the school, taking the lead position in many areas. For example, she is the Vice President of the Student Council and the Treasurer of the peer mentorship club in the school Aflatoun Club, where learners are educated about their rights and responsibilities and managing financial resources. Susan is motivated and vows to continue with her education whatever comes her way. She looks forward to joining a science based profession in future; she wants to be a nurse.

The support

As noted above, the role of the teacher has emerged as fundamental to raising numeracy standards in the classroom. However, ensuring that teachers are successful is not simply about additional training in mathematics or gender responsive pedagogy. Projects also emphasised the importance of producing simple guidance materials and providing incentives for achievement in their classrooms. Ongoing support, supervision and monitoring is important. Finally many projects have created structures where teachers are able to share their experiences and best practice.

The Education Development Trust project has introduced cluster meetings which bring all the teachers in a cluster to an experience sharing forum. The main objective is to enhance the capacity of teachers in curriculum delivery. Cluster meetings are conducted once every term for the Focus teachers from all schools within the cluster.

“Cluster meetings are necessary because they play a major role in helping the teachers find solutions to some of the problems they encounter as they carry out their work. One of the teachers summarised the importance of cluster meetings as follows; “Listening to other people’s challenges has encouraged me as a teacher to develop a positive attitude towards challenges and instead of getting demoralised, they strengthen and instigate my curiosity to finding their solutions. I also learn new ways of dealing with teaching/learning challenges.”

Sarah Looniyo, teacher coach in Nagis Cluster in Loima, Turkana County, Kenya

More ideas

The GEC projects also highlighted a number of other approaches that they were using to better engage girls in mathematics and improve standards overall.

- Exposing girls to role models – older girls and women who were enjoying and being successful in mathematics or a related career – and using peer-to-peer-mentoring, again with girls who are doing well in the subject.
- Increasing mathematics resources where possible, including locally sourced resources to try and ensure a sustainable and affordable supply.
- Introducing libraries and informal sharing arrangements, so that where resources, particularly textbooks, are in short supply they can be circulated and used more widely.
- Introducing regional competitions and quizzes to increase visibility of the topic and raise confidence.
- Promoting the importance and suitability of mathematics with girls, boys and parents through (often existing) community sensitisation programmes.
- Starting remedial lessons as early as possible and ensuring that they are run at appropriate times with the buy-in of parents (linked to the promotion above).
- Collaborating with regional and national government on teacher supply and training, consistency of messages (around the importance of STEM subjects and girls in particular) and resources.
- Using ICT in classrooms. Although there is no definitive evidence as yet, GEC projects using ICT to teach mathematics are reporting some emerging success in engaging students and raising achievement levels through online teaching programmes.

Most projects that responded on this topic also stressed the importance of considering the other aspects of a girls' life and understanding the context in which her achievement (or lack of) in mathematics might be impacted. For example, this might include tackling issues round attendance, addressing hunger and providing solar lamps for homework.

What next?

Global evidence on successful mathematics teaching points to many of the issues outlined above: the need for high-quality schooling, teachers who are themselves numerate and understand their subject, continuous professional development and ongoing support for those that need it, better data and feedback from assessments, appropriate mathematics curricula, more positive attitudes towards mathematics. But, in addition to these, when asked “*What would help you as a project to deliver better outcomes for girls' numeracy?*” GEC projects acknowledged that although we do not yet have conclusive evidence results, the following issues were important to consider:

- Greater opportunities to collaborate with government, with a greater focus on the continuous professional development of teachers in mathematics.
- An increase in women teachers – perhaps using university students to bolster numbers, especially in the short term.
- A greater emphasis on the teaching of financial literacy – particularly as these skills can often be passed ‘upwards’ to parents.
- The introduction of exchange programmes, between both teachers (to share experience and best practice) and students (to encourage greater self-confidence and share skills).
- Specific research into the gendered barriers to successful mathematics teaching and learning.

The Girls' Education Challenge has a zero tolerance policy on misconduct, including mistreatment of individuals and misappropriation of funds. If you would like more information on the whistle-blowing mechanism, or to report misconduct please email gecpmo@uk.pwc.com. The e-mail account is accessible only by a small number of individuals who have been trained on the requirement to keep the information confidential. We will follow up matters on an anonymous basis and are committed to investigate claims thoroughly and fairly.

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