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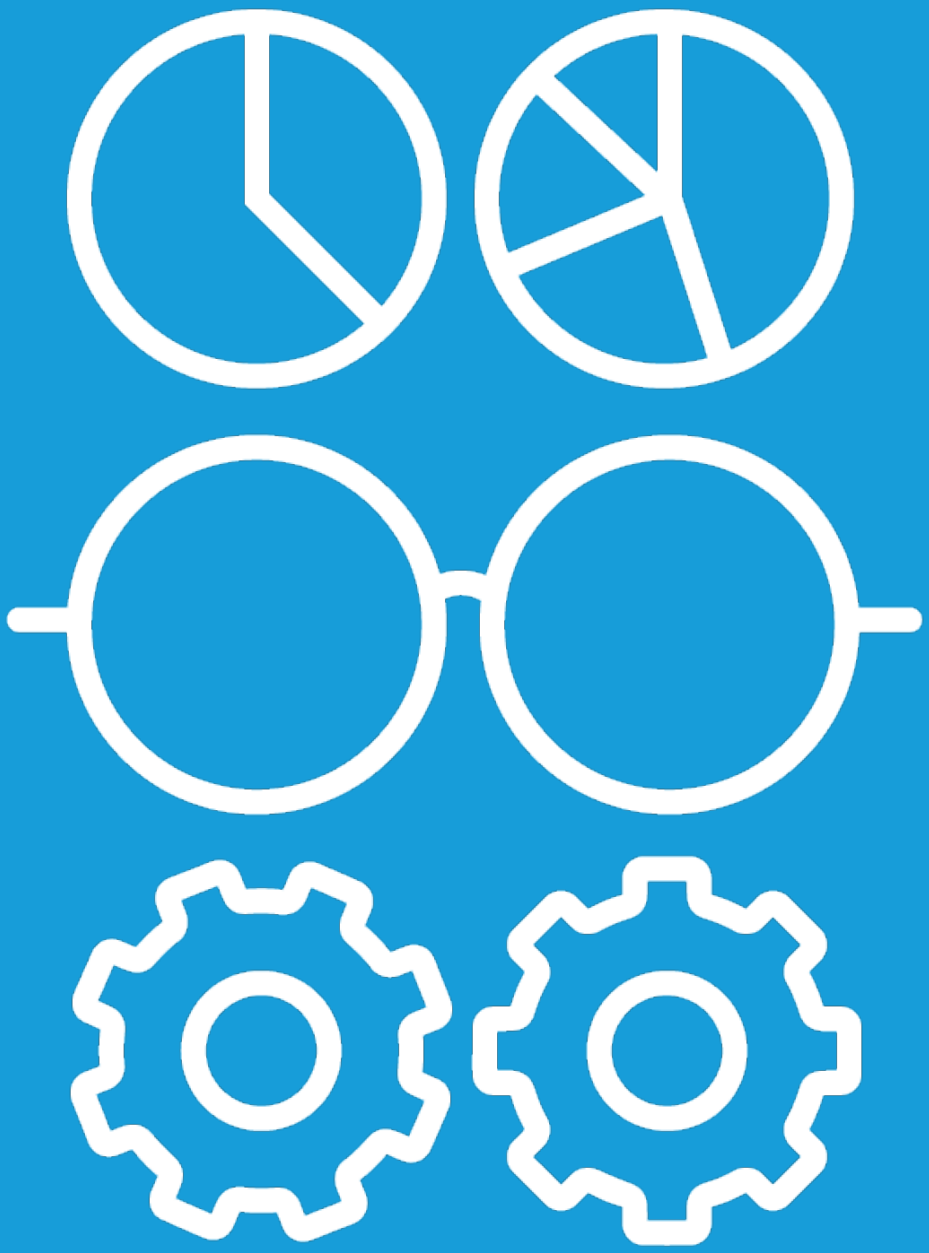
whizz EDUCATION



Data to Insight to Action

How Whizz Education has employed a course correction model to elevate the learning of students in rural Kenya to international standards

Contents

Executive Summary

In 2015, Whizz Education began work on an innovative education technology programme in Kenya called iMlango[1], a pioneering partnership with the Kenyan Ministry of Education, Science and Technology (MOEST) and the UK Department for International Development (DFID). This partnership is led by Avanti Communications Group, a leading provider of satellite data communications services, and also includes sQuid, Camara Education and Whizz Education. The project sets out to support children in 205 schools in Kenya who do not regularly attend school due to environmental, economic and societal issues by improving education outcomes in maths, literacy and life skills. Whizz Education leads on the maths component of the project.

Through this flagship project we have achieved substantial impact in supporting students and teachers in complex, low-resource settings to keep pace in their learning. To date we have worked with over 3,000 teachers and 100,000 students and, through continuous improvements to implementation design, we have observed a doubling of students' rates of learning when they enjoy sustained access to individualised tutoring. Just as importantly, we have experienced first-hand the considerable challenges associated with such an effort and, as an organisation committed to improving learning outcomes, taken tangible actions to ensure that these lessons are recycled into direct enhancements to both product and implementation. Our approach is predicated on understanding students' learning needs, monitoring their progress in real time and acting in partnership with relevant stakeholders to drive results.

Our approach acknowledges that optimum results are achieved when there is a strong partnership with the Ministry of Education and all stakeholders are fully engaged in the project, using the results to review their own systems and curriculum to improve teaching and learning and further inform the National Education Sector Policy. In addition, well-informed teachers who are trained to harness technology in the classroom are then able to drive students' accelerated learning gains. This model enables the whole educational ecosystem to transition towards improved learning outcomes.

Using a case study from Project iMlango in rural Kenya, we present a tested method for improving the quality of learning and teaching at scale through innovative ICT and best practice implementation. This paper outlines the approach taken by Whizz Education to capture and recycle educational insights on a continuous basis, and details the key lessons learned from the iMlango implementation.

[1] https://www.imlango.com/

Background to iMlango

Whizz Education is an education technology company committed to improving learning outcomes. We believe that every child deserves a learning experience that caters to their individual needs and pace of learning. For over a decade, we have partnered with schools, ministries and donor organisations worldwide to design and implement innovative solutions aimed at raising the quality of learning and teaching and supporting inclusive and equitable education.

Project iMlango was established in May 2015 as part of the Girls' Education Challenge, launched by DFID to afford the world's poorest girls an opportunity to improve their lives through education. iMlango is a ground-breaking partnership between public and private sector organisations, with the aim of improving Kenyan students' learning outcomes, enrolment and retention. iMlango operates in schools in four counties across Kenya: Uasin Gishu, Kilifi, Kajiado and Makueni. Whizz Education has responsibility both for delivering learning outcomes in maths and for building capacity of key education stakeholders to achieve success and has both trained, and continues to support, over 3,000 teachers in 205 rural schools to implement ICT, reaching over 100,000 students, many of whom have been marginalised by issues related to poverty.[2]

As part of Project iMlango, schools have access to the award-winning Maths-Whizz virtual tutoring programme, created by Whizz Education. It is composed of three components: an adaptive, online virtual tutor, which guides students through a comprehensive mathematical curriculum, delivering lessons tailored to individual needs; live reporting, which provides real-time data on student progress from the ongoing formative assessments built into the programme; and Teachers' Resource, a collection of lessons and instructional resources for teachers that support lesson planning and enable richer classroom dynamics. Within iMlango, 140 schools have access to the virtual tutor, as well as Teachers' Resource, while 65 schools have access to Teachers' Resource only. Additionally Whizz Education support the implementation with a field team consisting of 5 field officers and 2 operations managers who are responsible for supporting schools to embed Maths-Whizz into their day-to-day practice. This includes capacity building, action-planning, data sharing and conducting regular face-to-face visits with participating schools.

"Through multi-tiered professional development and real-time monitoring, all schools are trained and supported to integrate virtual tutoring to enhance their lesson planning, instruction and assessment. "

Our work is a partnership with diverse stakeholder groups, including parents, donors and government ministries. Through complementary activities with the Ministry of Education's Digital Learning Programme (DLP), we have been able to leverage our shortages/challenges for equipment and, in return, build teacher capacity to become champions capable of both embracing and driving governmental initiative. Similarly, in collaboration with our peers at DFID, we have had the opportunity to share reliable data on what is needed to deliver desired outcomes and support their strategic vision.

250
rural schools

3,000
teachers

100,000
students

[2] A brief video of Whizz and iMlango https://www.youtube.com/watch?v=PEY_m4pvTt0

Key question - and our approach to seeking answers

Project iMlango has explored three key questions around education and ICT:

1. **Access:** could technology infrastructure and ICT-enabled learning services be provided and made functionally operational at scale to rural, remote and resource-constrained communities?

2. **Quality**: do students achieve the expected learning outcomes once they have sustained access to these resources?

3. **Scale:** are there best practices that can be identified, codified and rolled out consistently to ensure these outcomes are achieved at scale?

This paper focuses on the question of quality by evaluating students' learning progress in Project iMlango over the past four years.

"Real-time data collection is a by-product of student learning"

A unique feature of Whizz Education's approach is real-time data collection: as students interact with the virtual tutor, learning analytics are captured immediately and reported back to key stakeholders, ranging from teachers and school leaders to government ministries and Whizz's own field staff through a central reporting system. As well as saving on the costs of manual data collection, the ability to track key learning indicators in real-time, and to aggregate this data at the level of students, classes, schools and regions, facilitates a proactive relationship with data, in which we can highlight both the bright spots and gaps of implementation as they occur.

Our approach to identifying best educational practices is thus iterative in nature: we regularly update our assumptions based on the regular streams of insights available to us. Crucially, while the project is benchmarked to external data via the usual Monitoring and Evaluation frameworks, we need not wait for midline and endline assessment data to identify what is and isn't working. Instead, we can employ rapid feedback cycles that recycle data insights into tangible, measurable improvements to both product and implementation tactics. It is a method of course correction that constantly directs and redirects our focus towards the intended destination of improved learning outcomes for all.

Data will only ever tell part of the story, and we rely heavily on the presence of our local field teams to extract the context around observed data trends. This ensures we can ask and answer the 'why?' and ascertain some of the causal environmental factors that enable or inhibit students' learning.

This approach transforms the binary and somewhat static question of 'what works?' into 'to what extent and in what context are things currently progressing?' We refer to this as a course correction model of monitoring and evaluation.

"Live learning data gives us information. On the ground engagement gives us the story. Information and the story combine to deliver actionable insight."

To chart the chronology of the iMlango project, we detail how both the product and implementation design have evolved within this course correction model. A provisional answer will be provided to the quality question based on our experiences and analysis to date.

Baseline evaluation: iMlango students experience an annual learning deficit of 42%

The essential first step in Project iMlango was the administration of the initial diagnostic assessment on Maths-Whizz that determines students' existing maths knowledge. The assessment serves two purposes. First, the virtual tutor defines an individualised learning journey for each student based on their assessment results. Second, the assessment data is aggregated to establish a baseline of students' maths knowledge.

Following the assessment drive, 27,155 initial assessments were completed, providing valuable data on the baseline knowledge and expected rates of learning progress for iMlango students as a whole. This initial diagnostic assessment data is automatically captured in the Maths-Whizz Central Reporting system, generating a baseline evaluation of the annual progress that iMlango students are expected to make in mathematics.

By calculating the average Maths Delta[3] of the 27,155 assessed iMlango students, it could be established:

1. that students in iMlango are, on average, between 4 and 5 years behind their international peers of the same age who are also studying through Maths-Whizz.

2. an estimated annual growth of iMlango students baseline of between Standards 2 and 6 is 0.58 years.[4] In other words, in the absence of the Maths-Whizz intervention, students could be expected to make 58% of the knowledge gains expected of them in a single academic year.

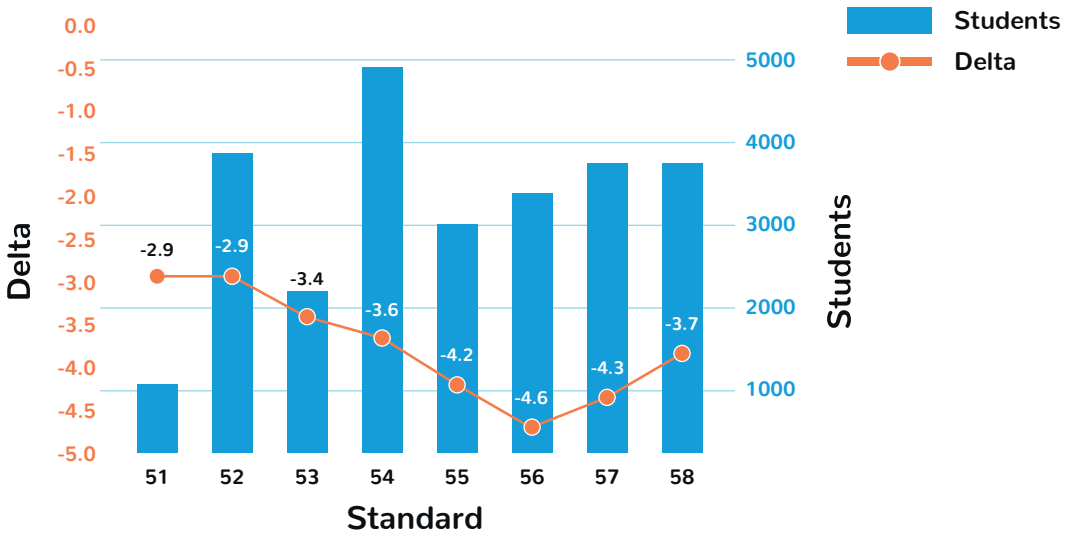


Figure 1: Average Maths Delta by Standard

(Note: Our analysis was restricted to these standards because of sample bias in Standards 7-8 that arises due to high school dropout at the end of Standard 6. Indeed, the upturn in average Delta in the chart above points to this issue of retention, which occurs because only the high attaining students achieve the grades required in their national assessments to continue their schooling in Standards 7-8)

[3] Maths Delta is defined as Maths Age - Actual Age. Since Maths Age is expected to correspond with Maths Age, a positive Delta can be interpreted as saying that the student is ahead of where they are expected to be in the curriculum, and a negative Delta implies they are behind.

[4] This analysis relies on a heterogeneity assumption that the average deviation of students' age from their expected age is the same in Standards 2-6.

The doubling of learning rates in rural Kenya

As students interact with the Maths-Whizz Tutor, we are able to track the rate at which they acquire core maths knowledge using the Progress Rate metric.[5]

A subset of iMlango students enjoy access to Maths-Whizz at the recommended usage level of 30-89 minutes per week. We are thus able to compare their progress through the maths curriculum with the learning gains made by their international peers at the same usage levels.

"Access to international data sets and experience allows Whizz Education to make comparative evaluation of progress and set higher expectations."

Whizz's research confirms that students in other territories typically achieve a Progress Rate of 1 when they sustain as little as 30-45 minutes of usage a week on Maths-Whizz, with many students accelerating their learning as they reach upwards of 45 minutes per week.[6]

Figure 2 below points to a steady increase in the average Progress Rate of iMlango students within recommended usage (30-90 minutes/week) during the first three and a half years of implementation.

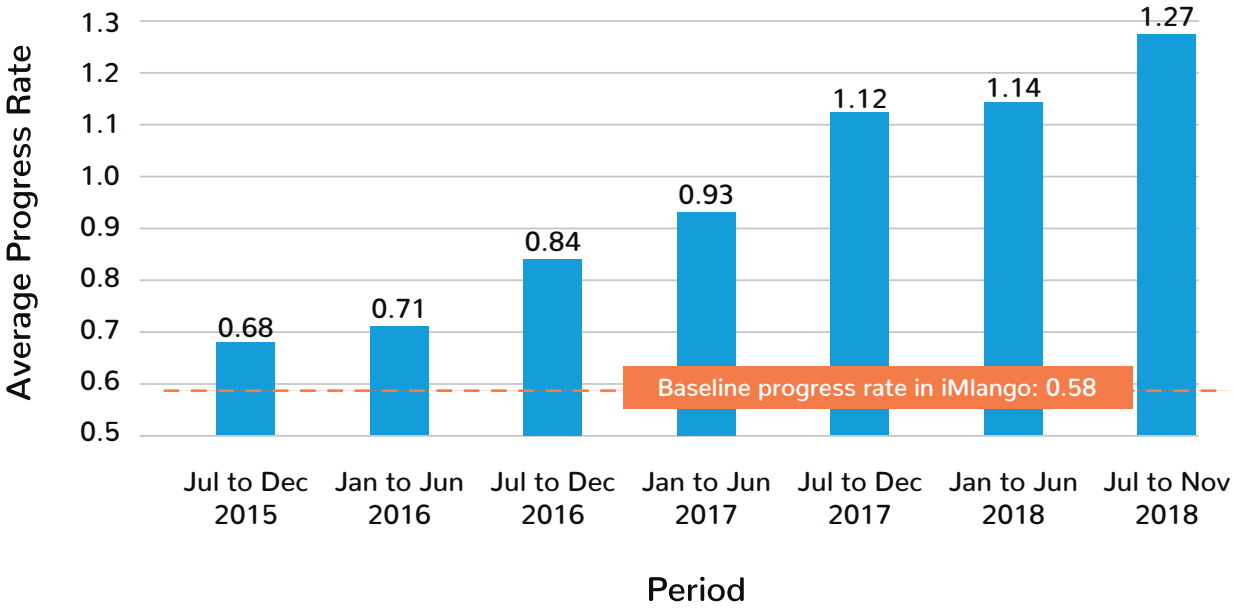


Figure 2: Time series plot of Progress Rate for iMlango students with 30-90 minutes of Maths-Whizz usage in each reporting period

[5] For any time period, Progress Rate is calculated as Change in Maths Age / Timespan (in years). Thus a Progress Rate of 1 indicates that students are progressing at the expected rate; Progress Rates greater than 1 point to accelerated learning and Progress Rates less than 1 suggest students are progressing less quickly than expected

[6] Proof Pack

This trend informs two conclusions:

1. In 2015, the Progress Rate for these students was 0.68, a full ten percentage points above the 0.58 baseline rate, although some way behind the Progress Rates observed for students at the same usage levels in other territories. Whilst Maths-Whizz was boosting learning outcomes for iMlango students relative to local peers, their learning rates still lagged significantly behind that of their international peers.

2. Over the past three and a half years, Progress Rates at recommended usage have climbed steadily, and are now showing not only accelerated progress but accelerated progress at levels comparable to other territories.

Significantly, the learning benefits afforded by individualised tutoring are thus proven to be extendable to iMlango students, yielding a positive answer to the question of quality.

"It has been demonstrated that students in resource-constrained environments such as iMlango can expect to enjoy learning progress comparable with students in more developed contexts."

In this context, the impact of Whizz Education's work on the learning outcomes of iMlango students can be considered transformational.

"The ability to track key learning indicators in real time, and to aggregate this data at the level of students, classes, schools and regions, facilitates a proactive relationship with data, in which we can highlight both the bright spots and gaps of implementation as they occur."

How continuous course correction guarantees long-term efficacy

The steady increase observed in Progress Rates is a natural consequence of Whizz's iterative approach to product and implementation design. The combination of data analysis and on-the-ground observation, which are situated in a virtuous cycle, has led to tangible improvements to the Maths-Whizz platform, methods of implementation and teacher training as well as adjustments to educational programme design.

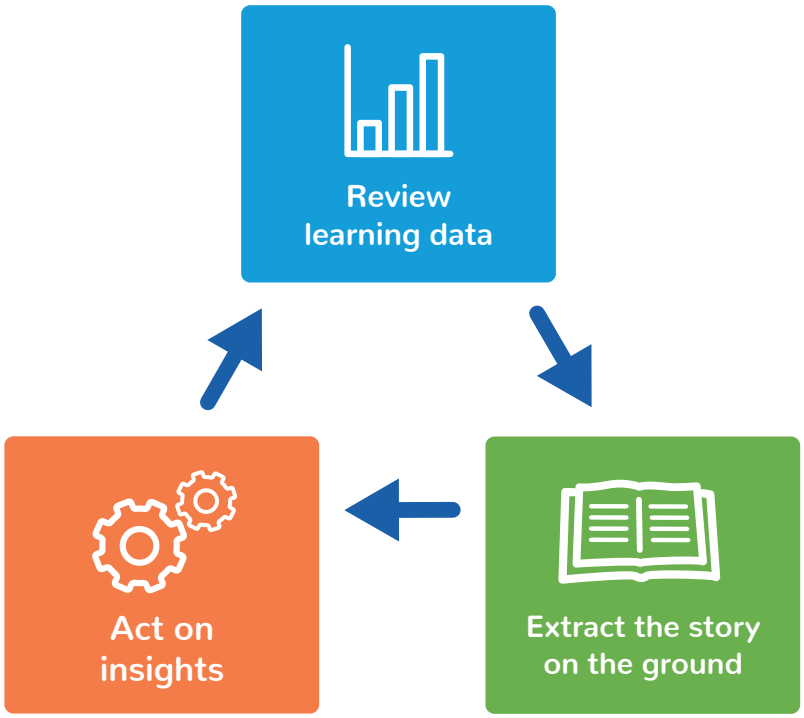


Figure 3: Whizz Education's course correction model

Examples of these course corrections include:

Tighter regulation of assessments: Following the initial diagnostic assessment, learning data revealed that many students experienced significant struggle in the early stages of tutoring, which hinted at an inaccurate assessment profile. The field team was tasked with identifying the root causes and in doing so, found that it was commonplace to observe students congregating at a single station, completing a student's individual assessment in collaboration. As well as corrupting that student's Maths Age, the individualised learning journey that is based on assessment results was adversely affected, with lessons proving excessively difficult for students.

Corrective action taken: the teacher training programme was adjusted to provide greater emphasis and understanding of the individualised, adaptive nature of the assessment. The field team responded with in-school coaching and by enforcing tighter regulation in the labs in which the initial assessments took place.

A more targeted assessment start point: in using the Maths-Whizz Tutor, students begin their assessment at a level determined by their actual age. The assessment subsequently adapts based on their progress through the questions. iMlango presented us with a challenge previously unforeseen: as the Delta analysis shows, actual age for these students can be a poor indicator of where they are in the curriculum. In iMlango, the problem is compounded by the fact that many students are unaware of their precise date of birth and are left to enter speculative figures to denote their age.

In other territories globally, the initial assessment bridges this gap with just a few questions, but iMlango students had to endure several failed questions before the assessment captured their 'true ability'. This is not only demoralising but consumes time that is better spent with the virtual tutor itself and runs the risk of assessing students too high (resulting in a tutoring experience that is overly challenging).

Corrective action taken: the Whizz Product team instigated a change in the online assessment process whereby students commence the assessment at a level based on the Standard (grade level) they are in, rather than their date of birth. This improved student motivation and assessment accuracy concurrently.

High levels of incomplete lesson attempts: A common observation in iMlango ICT labs was high instances of incomplete lesson attempts, which prompted our data analysts to ascertain that around 30% of lesson attempts were incomplete for iMlango students, compared to a global average of 11%. Contextual factors that contribute to such high rates in iMlango included restrictive lab schedules, as well as sporadic power and internet outages. At the time of these observations, the Maths-Whizz virtual tutor was not programmed to retrieve students' partial scores and thus required them to complete the whole lesson upon their return and resulting in significant lost learning potential for the Whizz Product team to address.

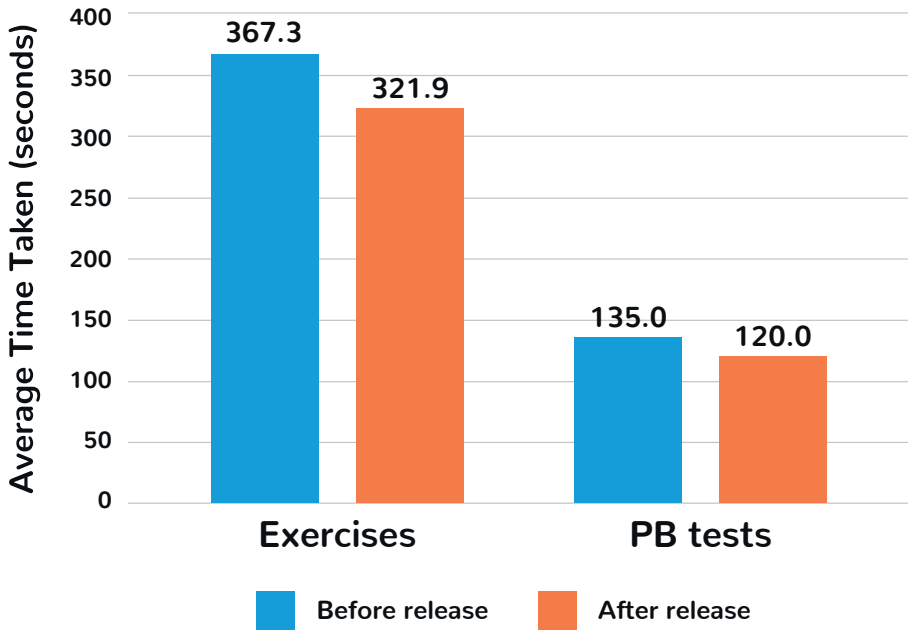


Figure 4: Lesson completion times before and after the bilingual student experience was released

> **The doubling of learning rates is the inevitable long-term impact of course correction.**

Corrective action taken: enhancements were made to enable the Tutor algorithm to take account of incomplete lesson attempts and thus adapt to students' needs more quickly and efficiently, allowing learning progress to be made at a faster pace.

Language: a major factor identified as having a detrimental impact on Maths-Whizz progress rates for iMlango students is literacy; particularly in the lower grades, iMlango students who lack fluency in English struggled to grasp some of the on-screen instructions, with the visual representations that underpin Maths-Whizz lessons only able to offset this deficit to a small extent, and engagement with the virtual tutor retains a dependency on language comprehension. The baseline report confirmed that one of the main subgroups within the project with lower progress was 'girls with language of instruction different to mother tongue', who demonstrated low proficiency in most subtasks of numeracy.

Corrective action taken: to address the language barrier, we introduced a bilingual version of Maths-Whizz that allows students to experience lessons in either English or Kiswahili, depending on their needs. This was a long term project and was released in two phases (lower and upper grades respectively) in 2018. Our analysis points to an improvement with an 11% reduction in the time it takes students to pass a lesson on Maths-Whizz when they are able to choose between the English and Kiswahili versions:

In summary: the course correction model employed by Whizz has determined an approach to working with data whereby it should be reviewed in real-time, paired with in-field observations, and used to drive continuous improvement through targeted, measurable actions.

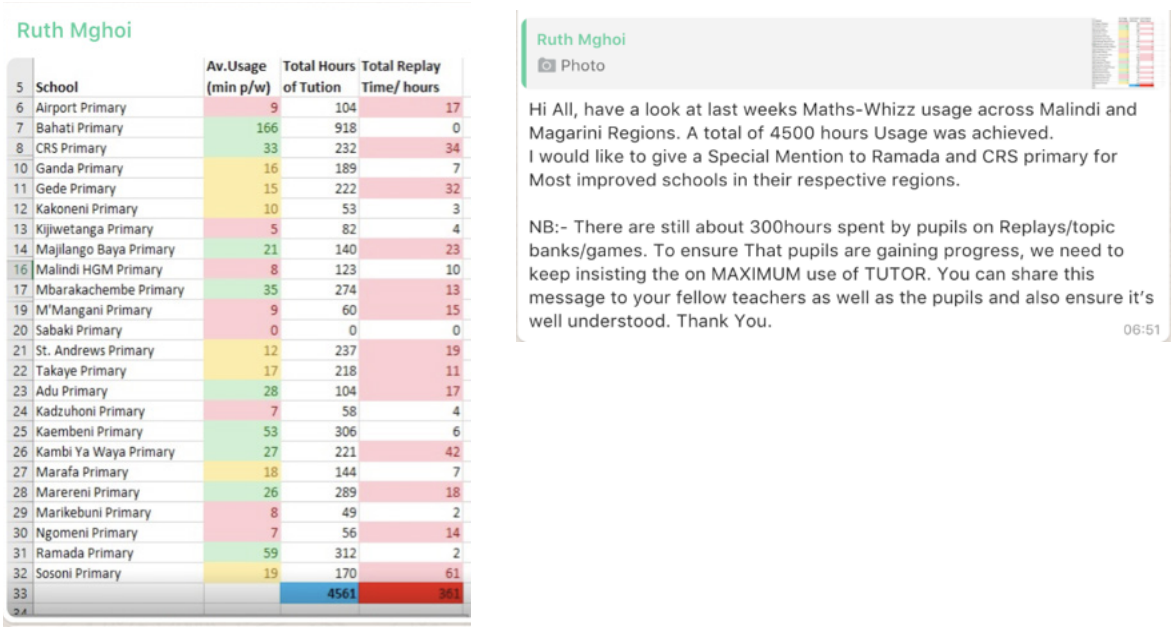
Capacity building in schools

The impact of ICT on students' learning is inextricably tied to capacity building within schools. It's imperative that the same principles of course correction outlined above also govern the working relationship developed with schools benefiting from the iMlango programme.

Professional development: Teachers and school leaders in Project iMlango often lack both the confidence and the skill to deploy ICT programmes with fidelity. We have therefore developed a multi-tier model of professional development, aimed at teachers, school leaders, representatives of the Ministry of Education and Teacher Service Commission (TSC) and members of the Head Teachers and Board of Management (BoM) of each iMlango school. The benefits for these stakeholders are felt both in the specific domain of teaching a maths curriculum, and in the broader proficiency they develop through an improvement in their core ICT skills.

Timetabling: It soon became apparent that schools required support in embedding Maths-Whizz into their learning processes. Our field team therefore work closely with school administrations throughout the year to implement a functioning lab timetable which staff adhere to. Integrating the lab timetable with the school's 'block' timetable further normalises the use of Maths-Whizz as a vehicle for teaching and learning mathematics.

Real-time collaboration: Supported by live data insights that provide visibility on high and low usage schools, our model has been repeatedly updated to respond to the needs of each school. An example of this is the creation of WhatsApp groups, which facilitate real-time support and sharing of best practices within each iMlango county.



Ruth Mghoi

	School	Av.Usage (min p/w)	Total Hours of Tution	Total Replay Time/ hours
6	Airport Primary	9	104	17
7	Bahati Primary	166	918	0
8	CRS Primary	33	232	34
10	Ganda Primary	16	189	7
11	Gede Primary	15	222	32
12	Kakoneni Primary	10	53	3
13	Kijiwetanga Primary	5	82	4
14	Majilango Baya Primary	21	140	23
16	Malindi HGM Primary	8	123	10
17	Mbarakachembe Primary	35	274	13
19	M'Mangani Primary	9	60	15
20	Sabaki Primary	0	0	0
21	St. Andrews Primary	12	237	19
22	Takaye Primary	17	218	11
23	Adu Primary	28	104	17
24	Kadzuhoni Primary	7	58	4
25	Kaembeni Primary	53	306	6
26	Kambi Ya Waya Primary	27	221	42
27	Marafa Primary	18	144	7
28	Marereni Primary	26	289	18
29	Marikebuni Primary	8	49	2
30	Ngomeni Primary	7	56	14
31	Ramada Primary	59	312	2
32	Sosoni Primary	19	170	61
33			4561	361

Ruth Mghoi
Photo

Hi All, have a look at last weeks Maths-Whizz usage across Malindi and Magarini Regions. A total of 4500 hours Usage was achieved.
I would like to give a Special Mention to Ramada and CRS primary for Most improved schools in their respective regions.

NB:- There are still about 300hours spent by pupils on Replays/topic banks/games. To ensure That pupils are gaining progress, we need to keep insisting the on MAXIMUM use of TUTOR. You can share this message to your fellow teachers as well as the pupils and also ensure it's well understood. Thank You.

06:51

Figure 6: Field Officer Ruth Mghoi posting on WhatsApp group to share weekly usage for Kilifi county

Data sharing with schools: The Whizz Education model develops an agreed action plan with every school and stipulates a number of SMART (Specific, Measurable, Achievable, Relevant, Time-bound) objectives for teachers and head teachers. This serves as an ongoing reference point in their relationship with Whizz. In turn, learning data from Maths-Whizz Central Reporting facilitates tracking of progress towards these objectives. The Field team compiles a range of reports including weekly updates that compare schools' progress within each region. Teachers and school leaders are encouraged to access the same data which is available within the Maths-Whizz product.

Post-activity analysis: All activity is date-stamped, allowing robust evaluation of pre- and post-activity data. This micro-analysis is the basis for both prioritising activities and allocating resources.

The importance of capacity building is exemplified by the case of Bahati Primary, a rural school based in Kilifi. In the early years of implementation, average usage across 300 students sat at 2 minutes/week. Following a turnaround effort, which was driven by the new head's buy-in and more embedded practices such as data sharing, this figure rocketed to over 100 minutes/week. In fact, both usage and learning progress have consistently placed Bahati among the highest ranked Whizz schools worldwide. These results are made all the more remarkable in the face of Bahati's resource constraints and have earned recognition as the case study for which Whizz Education won a BETT award in January 2019 for 'Collaboration with a School'.

> **Both usage and learning progress have consistently placed Bahati among the highest ranked Whizz schools worldwide**

Conclusion

Whizz Education is a holistic implementation partner; through a combination of expertise in education programme design, programmatic implementation and knowledge of effective ICT in education, Whizz is continually learning and improving to further enable the delivery of sizeable gains in students' progress.

The experience and insight gained from Project iMlango are anchored to the three guiding questions of access, quality and scale. Whizz Education employs a course correction model which is both successful and sustainable to address each of these goals.

This paper has demonstrated a positive answer to the question of quality. The original intervention design, centred on the benefits of a proven tutoring platform, yielded only a modest learning impact in the early stages of implementation (progress rates were at 0.68 for recommended usage students, ten percentage points higher than the 0.58 baseline). The systematic and repeated process of insight gathering and incremental improvements, as defined by Whizz's course correction model for monitoring and evaluation, has yielded a significant and positive impact (progress rates have risen from 0.68 to 1.27 over the past four years), bringing the learning rates of students in rural Kenya in line with international standards.

"It is unlikely that any ICT in education programme would be designed so effectively to reach optimised results from the get-go. It is this systematic course correction infrastructure and capability that distinguishes Whizz's approach to deploying ICT in learning environments. Course correction holds the key to attaining transformational outcomes over the long run."

While early indications point to Maths-Whizz students enjoying superior outcomes in high-stakes national assessments, a larger-scale analysis is currently being conducted to evaluate the correlation between Maths-Whizz learning data and KCPE exam results.

Our focus now turns to the question of scale. and how we can ensure more students achieve sustained and productive access to the Maths-Whizz Tutor. We look forward to uncovering further insights from the ground, and to seeing how the work of Whizz Education, underpinned by an ethic of continuous improvement through course correction, evolves in the months and years ahead, further fulfilling our mission to enable communities to reach their full potential through individualised learning.

We welcome the opportunity to discuss ways to work towards achieving transformational change in learning outcomes for children around the world. Contact us at whizzeducation.com or email global@whizzeducation.com