THE PEARS PROGRAM-ISRAAID PILOT FUND

The *Mathika* Pilot Project

April 2021

Internal Evaluation Report

Executive Summary

The Pears Program-IsraAID Pilot is aimed at serving communities affected by humanitarian crises through field testing of Israeli technologies in IsraAID's countries of operation, with a view toward their long-term, sustainable deployment. Mathika, a software designed to teach learners aged 5-13 math through games and video clips, is among the innovations supported by the program. The software was piloted in refugee and migrant communities, given its potential to create a self-paced learning environment, which addresses barriers faced by children "on the move", who often have limited educational support and insufficient command of a written language.

This report, then, assesses the extent and ways in which *Mathika* addressed some of the barriers to learning that exist in vulnerable and – particularly – refugee and internally displaced communities. In the framework of a six-month pilot program, 32 refugee and migrant learners in Sindos, Greece and 50 learners in Barranquilla, Colombia used the software one-hour per week. In total, learners used the software anywhere from 10 to 22 hours in total.

The pilot's desired outcomes as defined at the outset:

- **Migrant and refugee learners improve their mathematical skills.**
- **Migrant and refugee learners improve their mathematics resilience** (including increased perseverance, heightened confidence, and reduced anxiety in learning in general and in learning math in particular).

In tandem, the pilot is aimed at improving our understanding of whether and how the software can be best used in humanitarian settings, particularly in refugee and other migrant communities.

Relying on the staff's collection of data, including pre-post tests (in Colombia), interviews, observations and additional methods, **the evaluation focuses on the following questions:**

- **To what extent were the pilot's predefined objectives achieved**, including the key outcomes of improvement in math skills and increased confidence and resilience in learning, and were the milestones of progress through the stages of the application and positive user experience met?

- **What can be learnt from the pilot's implementation in humanitarian settings**, particularly regarding adaptation of the platform to address issues of connectivity and access, national standards, and cultural and linguistic issues?

<u>Some key findings:</u> *Mathika* was perceived by most stakeholders as a useful math teaching platform as well as a potentially productive tool in a wider strategy of advancing learners' digital education. It is emphasized that the findings in the report pertain to the use of the

software in a **structured setting** with supportive adult presence; they are less relevant to independent learning.

Improvement in math skills: The average score of learners taking the test before and after the program (N=50) increased from 67 to 72, respectively. The average score of younger learners, mostly preschoolers and first graders (N=31) increased from 62 to 70. When dividing the scores into three main categories – a "low" score of 59 or less (indicating math skills significantly below grade level), a moderate score of 60-79 and a high score of 80-100 (math skills in accordance or higher than grade level) – it becomes clear that participating in the pilot has helped learners with a "low" score at the beginning of the program to obtain a "moderate" score at its end. 40% of learners tested in September 2020 received a "low" score; in February 2021 only 14% of them received a score in the "low" category. The number of learners receiving "high" scores increased as well, but not to the same extent. Given that Mathika sessions were the only math trainings undertaken by the children who took the pre- and post- tests, our assessment is that changes can be attributed primarily to the use of *Mathika*.

Enhanced mathematics resilience: Focus groups with learners and interviews with teachers in both countries indicate that the structured sessions with *Mathika* contributed, to varying extents, to learners' confidence and resilience in math. Its approach to problem solving (for example, the in-game hints) was identified as conducive to building up motivation and confidence in learning.

Progress within Mathika: In Colombia, during September-December 2020, preschoolers, first and second graders demonstrated 30% progress in *Mathika (i.e.* they completed 30% of the levels or "planets" in the software), while answering correctly 69% of the exercises. Older learners answered 81% of the questions correctly but they completed 19% of the levels. In Greece, younger learners demonstrated 20% progress while accurately answering 63% of the questions. Hence, answering correctly did not translate into progress. It was enthusiasm toward the software and the experience in general that was positively correlated with progress in *Mathika*, not the accuracy of answers.

Positive user experience: Most students (and teachers) reported that the platform is "fun", expressing satisfaction with the alternative learning method and with what they perceived as "a balance of playing and learning". The students themselves requested that structured time on the platform will be lengthened from half an hour to a full hour. Several issues emerged when considering the students' user experience and satisfaction, including the continued importance of the teacher's role in migrant and refugee settings, the facilitation of independent learning, and the adverse effects of both limited connectivity and access to hardware.

Recommendations are are presented at the end of the report, including references to the role of the platform in promoting digital education, training of teachers and more.

Introduction

In 2015, all United Nations member states adopted the Sustainable Development Goals - a universal call for action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. The fourth of the 17 SDGs states the need to "*ensure inclusive and equitable quality education and promote lifelong opportunity for all*". Ensuring inclusive and equitable quality education is often a challenge in the context of learners in refugee and internally displaced (IDP) communities. With approximately 13 million refugee and 17 million internally displaced children worldwide, technological innovations in education may play an important role in the achievement of SDG 4.

In 2019, the Pears Program-IsraAID Pilot Program published a call for proposals inviting startup and more established companies to submit innovative technologies that could address humanitarian needs identified by IsraAID in its countries of operations, with an emphasis on Education and Water, Sanitation and Hygiene. The overarching objective of this initiative is to improve the lives of those affected by humanitarian crisis by utilizing Israeli innovations, with a view to adding these technologies to the humanitarian aid implementation toolbox. To that end, the Pears Program and IsraAID selected applicants who participated in a short training program introducing key concepts in humanitarian aid. The selected technologies were then adapted to the relevant context and piloted in selected IsraAID countries of operations. Throughout the implementation, IsraAID collected data and monitored progress to assess the relevance and effectiveness of the technology in the selected humanitarian setting.

Mathika™ (see link for additional information in Hebrew and Arabic) is one of the first technological innovations piloted in the framework of the program. *Mathika* is a platform targeting children aged 5-13, allowing experimentation in mathematical problem-solving, concepts and thinking in an independent and self-paced environment. Progress can take place individually by advancing through the different levels, or "planets", navigating from one "planet" to another. According to its developers, the software was designed specifically to deal with challenges such as young learners' math anxieties, class heterogeneity in math skills, and learning disabilities, and to do so in a "freestyle" way that would improve imaginative and critical thinking. An independent learning track that crosses age groups can be set for each learner, which enables teachers to maintain differential learning. By so doing the software is aimed at allowing teachers to quickly identify and address the needs of learners who lag behind their peers or of more proficient learners, who need new challenges.

Mathika™ is part of Imagine Machine™, a team of parents, educational experts, teachers, game developers and designers who create innovative game-based learning tools. The group has worked in the Middle East, Europe and South America, and its customers include public schools,

private schools, homeschooling and alternative education frameworks and others.

This report comes to assess the deployment and piloting of ***Mathika-Imagine Machine*** with **migrant children in Sindos, Greece and Barranquilla, Colombia**. Several considerations led to the deployment of *Mathika* in refugee and migrant settings. The software's added values were to address some of the challenges often faced by children in these communities: academic gaps vis-à-vis other children, due to prolonged absences from school; limited command of a written language; insufficient and inconsistent access to qualified teachers; and an overall absence of a positive, encouraging learning environment.

The overall expected outcome of the pilot was to improve refugee children's ability to learn and progress in math, thereby overcoming academic gaps and mitigating the effects of prolonged absences from the education system. Overcoming these gaps can ultimately facilitate easier integration into the school system and beyond. **More specifically, the pilot's desired outcomes** as defined at the outset were:

- Migrant and refugee learners improve their mathematical skills.
- Migrant and refugee learners improve their mathematics confidence and resilience.

In tandem, the pilot's evaluation is aimed at generating an improved understanding of how the software can be best used in development and humanitarian settings.

What follows is a short literature review; overview of the locations, context, and target audience with which the software was deployed; a presentation of the evaluation process; a summary of the findings; and conclusions and recommendations.

Educational Technologies: Literature Review

This evaluation of the *Mathika* pilot is informed by a review of some of the extensive literature assessing the utilization of technology in educational programs. Researchers identify positive effects of incorporating new technology on students' independence, enthusiasm, and responsible attitudes towards learning. Furthermore, the positive role of technology in improving math skills was demonstrated in the Global South, including in refugee and migrant settings. (Sung et al., 2016; Mwingirwa & Miheso-O' Connor, 2016; Ally et al., 2017). Likewise, the notion of narrowing educational gaps by using technology evolved during the past 30 years. The recent refugee crises spotlighted the use of mobile technology for educational purposes, demonstrating its effectiveness (Ally et al., 2017) and capacity to disseminate educational content in camps with limited internet access and limited or no electricity.

Several themes of relevance to *Mathika*'s deployment emerge in the literature regarding the benefits and constraints of utilizing technologies in formal and informal educational settings:

Curated learning: Using self-directed programs, technological mobile materials can allow students to develop their independence (Ally et al., 2017). Students in such contexts may progress at their own pace and improve over time. At the same time, platforms that provide accurate and detailed feedback allow educators to respond better to the different needs of their students (Guma et al., 2013).

Increasing motivation: There is evidence that the use of technology in learning can raise the curiosity and motivation of end users, encourage continuous learning and contribute to positive interactions and relationships (Zakaria & Khalid, 2016), especially when combined or incorporated within a game-based framework (Sedig, 2008). Learning through technology allows utilization of images and voice at the same time, which improves the understanding of mathematical ideas. Additionally, it creates a new option for students to learn outside formal school hours (Musiimenta et al., 2019). Some mobile learning projects were found to increase child learners' interest in studying, leading to improved test scores and indicating that the use of tablets for learning can improve student performance (Ally et al., 2017).

Cultural barriers & significance of context: The literature identifies pervasive negative cultural attitudes towards math among children from vulnerable populations, including refugee and IDP populations. Language barriers create difficulties when using software or devices that are not in the users' native language, affecting the learner's performance (Setati, & Barwell, 2008). One can also find concerns regarding the decontextualized application of technology, specifically when working with refugees; regarding, for instance, when interventions assume previous exposure to digital devices when introducing a software for mobile learning, which may further deepen existing gaps (Menashy & Zakharia 2020).

Accessibility: Previous experience in using computers and tablets and the availability of technological resources/devices outside of school are key factors in the successful leveraging of technology for learning. It also affects educators who do not have access to the necessary technology outside of school, impeding their preparation of teaching materials (Zakaria & Khalid 2016). Thus, availability and access to the relevant technological infrastructure and resources, both at school and at home, should be carefully considered when employing technological innovations in educational programs (Guma et al., 2013).

Training and "know-how": The literature also reminds us of the importance of adequate training on the use of new technology. Zakaria & Khalid (2016) address the limited pedagogical knowledge on how to integrate relevant technologies in teaching, noting that it is essential to develop training programs for mathematics educators prior to adoption of technological tools in the classroom and beyond. In the same vein, a lack of technical support can also be a constraint, and provision of such support can be key for technologically innovative projects to succeed (Ally et al., 2017).

As seen throughout the report, these themes are of relevance to both achievements and challenges that became apparent during the pilot's implementation.

Background, Context and Target Audiences

IsraAID ultimately decided to pilot the software in **two locations**:

Sindos, northern Greece: A small town of 10,000 people close to the city of Thessaloniki in northern Greece, the town hosts a refugee population of approximately 500, housed in ESTIA (European-funded) apartment buildings. Approximately 40% of the community are from Syria, 18% from Iraq, with the rest from Iran, Afghanistan and countries across sub-Saharan Africa. 42% are native Arabic speakers. There are 54 learners aged 5-14 in the community; all attend the local public schools in Sindos.

IsraAID operates a community center near the refugee accommodation, attended by up to 100 community members each day. In July 2020, 32 learners who participate in the community center's afternoon classes were selected to participate in the pilot (all of whom are registered to local Greek public schools). They were divided into 3 groups in line with their age: 6-8, 9-10 and 11-12 who participated in one-hour lessons facilitated by a teacher, totaling 10, 16 and 14 hours of using *Mathika*, respectively. With a teacher present and a personal computer for each student, all levels of the software were opened, and the learners were able to navigate from one level to another as desired. From the outset in July, concern regarding Covid-19 impacted attendance at the community center, as residents were encouraged to remain at home as much as possible. The implementing team sought to overcome the challenge through the platform's added values.

However, during an extended period of lockdown – and the closing of the center - beginning November 2020, no use of the application was recorded. Learners and their parents reported very limited internet connectivity as well as insufficient hardware (that is, not enough personal computers or tablet devices in the household). Due to these challenges and in order to mitigate the disruption in education, the IsraAID team reverted to more traditional learning methods, including house visits, delivery of printed homework, and WhatsApp correspondence. The learners did manage to use WhatsApp given its modest requirement in terms of data and more limited use of parents' or family members' cellular telephones.

Barranquilla, Colombia: The neighborhood of Villa Selene is located to the southwest of Soledad, Atlántico, in the metropolitan area of Barranquilla. 70% of the population of the neighborhood are migrants. Villa Selene has been a major destination for Venezuelan immigrants who have settled in this area. Its houses were mainly assigned to victims of the internal armed conflict and families originating from high-risk bordering towns. The neighborhood has many vulnerable children, whose basic needs are not met. Consequently, several NGOs have prioritized this area, aiming to ameliorate the conditions of migrating families. IsraAID partnered with the Centro

Educativo Integral “Nueva Esperanza” (CINE), established about 20 years ago by a group of local female leaders who initiated a place where children could obtain education.

CIENE selected 50 children from this area to participate in the *Mathika* pilot; learners who did not attend the formal education system for over a year (nearly half did not attend for two years or more). They were placed in one of two groups of 25 learners each based on their age: learners from 6 to 9 years belonging to the first group (“A”) and learners aged 10 to 13 years old belong to group “B”. Most learners had limited familiarity with computer hardware before the program (including laptops, tablets, keyboards etc.). With a teacher present, each group had a total of 24 sessions totaling 22 hours (20 one-hour and 4 half-hour sessions) between September 2020 and February 2021. Unlike in Greece, the students needed to complete a level before being able to move to the next, and the work was done on tablet computers rather than desktops.

As in Greece, Covid-related restrictions affected implementation, particularly as learners in both locations had limited internet connectivity. More than 80% of the children’s households had internet access only through mobile data, indicating inability to afford and/or not prioritizing more reliable internet access.

The evaluation: Focus & Methodology

The evaluation focused on the following questions:

- **To what extent were the pilot’s predefined objectives achieved**, including improvement in math skills and math confidence and resiliency, progress through the stages of the application and positive user experience?

- **What can be learnt from the pilot’s implementation**, particularly regarding adaptation of the platform to address issues of connectivity and access, national standards, and cultural and linguistic issues?

To that end the following data collection tools were administered to *Mathika* users and other key stakeholders:

- Pre- and post-implementation mathematics examinations taking into account national educational standards for the different grade levels (completed by learners in Colombia)
- Literacy test (completed by learners in Greece)
- Mathematics confidence and resilience questionnaire (completed by Mathika users in both locations)

- Review of the software's database by IsraAID teams
- Focus group design and interviews of parents, students and teachers
- Structured observations of the lessons by IsraAID's teams
- Joint focus group with the teachers and implementing teams in Colombia and Greece

The implementing teams in both countries collected the data. Due to the Covid-19 restrictions that impeded both gatherings and the use of the software, the Greece staff ultimately was not able to administer the post-program test and the resilience questionnaire, and due to the extensive lockdown and closing of schools it was not feasible nor relevant to receive feedback from schoolteachers. In Colombia, the math confidence and resilience questionnaire was administered once, before the program.

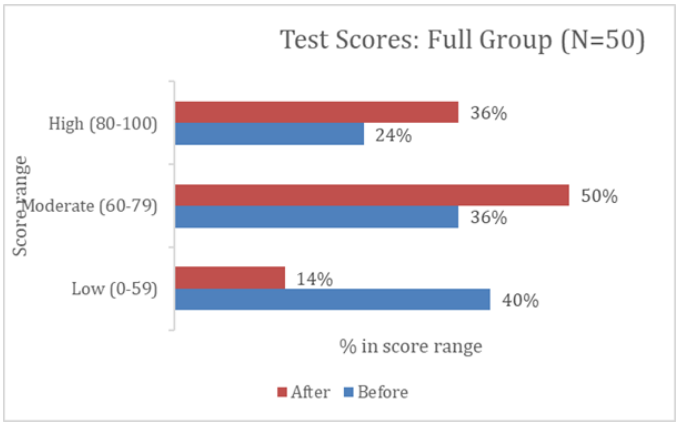
While lessons learned and the insights presented in the report were gleaned from both locations, based on the data collected and the experience and analysis of the implementors, given the data-collection challenges in Greece most of the quantitative figures presented below (notably of "pre" and "post" test scores) are drawn from implementation in Colombia.

Findings & Analysis

What follows is a description of the pilot's results presented in line with the desired outcomes and milestones that were set in advance:

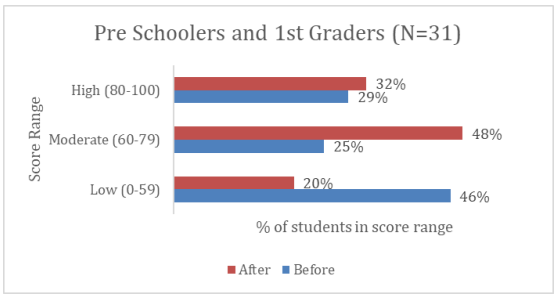
Outcome 1: Learners improve math skills, as measured by math test scores before and after the program:

In assessing the pre- and post-test math scores - taken respectively in September 2020 ("Before") and February 2021 ("After") - it is important to acknowledge that the 22 hours in which the learners used *Mathika* was the only math training they received during these months. The improvement in test scores can therefore be primarily attributed to participation in the pilot program.

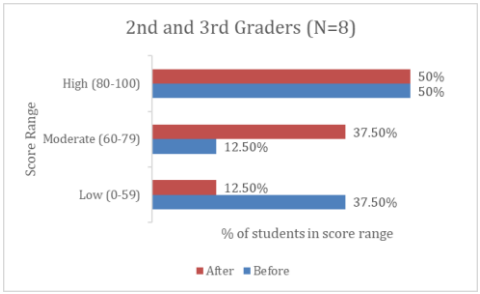


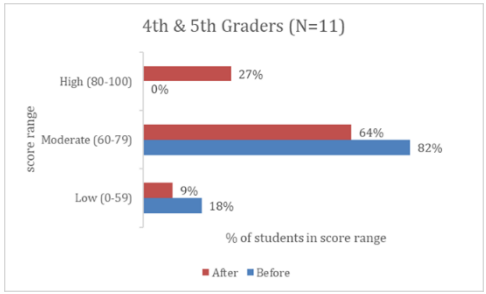
The overall average test score of the 50 learners increased modestly, from 67 in the September pre-test to 72 in the September 2020 post-test. Among the largest group, of younger learners (N=31), the score increased from 62 to 70. When dividing up the scores into three main categories – a "low" score of 59 or less (out of 100, indicating math skills significantly below grade level), a moderate score of 60-79 and a high score of 80-100 (score in grade level or

higher) – it becomes clear that participating in the pilot has helped learners with a "low" score at the beginning of the program to obtain a "moderate" score at the end. Whereas 40% of the learners received a score in the lowest range (59/100 or less) in September 2020, the figure dropped to 14% in February 2021. The number of learners receiving high scores (80/100-100/100) has increased as well, but not to the same extent. The pilot's most significant contribution, in all age ranges, seems to have been the acquisition of basic mathematics skills by those who had little previous knowledge. While the improvement of the students with higher pre-test results was less significant, five students, four of whom are 4th and 5th graders, were able to move from the middle to the highest score range.



According to the teachers, the improvement in math test scores is comparable to what could have been achieved in face-to-face meetings of similar scope. They did emphasize that the combination of teaching methods, with and without *Mathika*, is advantageous in terms of improvement of math skills.





Significantly the pilot was perceived by staff and especially by parents (and in some ways by students) as valuable in promoting not only math skills but **digital education**; that is, in familiarizing students with devices and with technological features to which they had limited previous exposure. An indication was that in Colombia, students in the formal education system who reported regular exposure to digital platforms needed roughly 2 days to feel comfortable on the platform, while others needed at least a week to adapt to the hardware and software and to use them correctly. Students' general comfort with the devices increased as the pilot progressed.

Outcome 2: Learners improve math confidence & resilience, including attitudes toward learning in general and math specifically

Along with developing learners' mathematics skills, the program also aimed to develop a more positive attitude towards learning and specifically towards math, as well as academic perseverance, and to reduce anxiety that is often associated with learning math. It was noted by the implementing team that these attributes may cause learners to think about their lack of

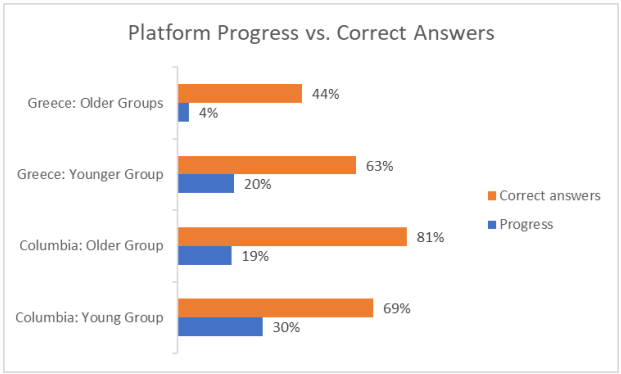
formal education and experience setbacks in their learning. In a survey administered in both Greece and Colombia at the beginning of the program, learners reported some anxieties and limited learning perseverance – for about 20%-25% of the learners these sentiments were more acute.

Overall, students invested substantial efforts and displayed signs of perseverance in learning mathematics throughout the pilot. They were positive and appreciative of the learning opportunity. In focus groups with learners and interviews with teachers, many said that the experience with *Mathika* contributed to their confidence and helped build a more positive approach toward math. Observations also demonstrated how when solving math exercises students were not hesitant nor concerned about making mistakes. Most were assertive and confident in answering questions. A few in both Grece and Colombia said that, unlike in classroom settings, they would not get discouraged when unsuccessful in completing a task, given the software's video-hints that help them overcome doubts. They stated that they are completing the exercises independently.

*****

Output 1: Students progress within *Mathika*

In Colombia, during September-December 2020, first and second graders demonstrated 30% progress in *Mathika (that is, they completed 30% of the "planets" or levels in the software)*, while answering correctly 69% of the exercises. Older learners answered 81% of the questions correctly but their progress was 19%. And a group of learners who are within the formal education system, likewise, made little progress (14%) even though 86% of their answers are correct. In Greece, younger learners demonstrated 20% progress while answering 63% of questions accurately. Thus, answering correctly did not translate into progress. It was enthusiasm toward the software and the experience in general that was positively correlated with progress in *Mathika*, not the accuracy of answers.



Older learners in Greece made little progress (2%-4%) answering 44% of the questions correctly. Many of them demonstrated difficulty concentrating and teachers reported they focused mainly on the playful aspects of the software. However, they did spend some time in lower levels, importantly filling gaps they may have, which is not reflected in the reported progress.

One thing that emerged when considering progress is that initial allocation of 30 minutes was perceived by students (and parents) as too short and was extended to a full hour. One hour a

week was also perceived by many as insufficient, but due the connectivity and hardware constraints most students could not spend additional time at home on the application.

Output 2: Students have a positive user experience with *Mathika* and report high satisfaction with the platform

In focus groups and interviews, most students (and teachers) stated that the platform is "fun", expressing satisfaction with the alternative learning method and with what they perceived as "a balance of playing and learning". As noted, it is the students themselves who requested that structured time on the platform be lengthened from half an hour to a full hour.

Several issues emerged when considering the students' user experience and satisfaction:

The role of the teachers remained essential, not least since the function of teachers as supportive adults is essential in refugee settings. Teachers were further observed to take part in the learning process by fielding questions - initially 2-3 times per class by each student in Greece, for example. These were mostly technical questions about the platform at first, and the focus gradually shifted to mathematical content. Teachers also incorporated stories and games, reminded students verbally and nonverbally to focus on the task, and more.

An added value of the platform is its emphasis on independent, self-paced learning that "allows learners to figure things out by themselves". Teachers report that while they "*tried to let the learners overcome challenges by themselves, we never let them completely on their own, [because] it is essential for refugee children to know that they have someone on their side, otherwise they lock themselves and stop trying*."

Command of a written language: In the pilot program and particularly in Greece, teachers reported that some younger learners found the software less accessible because of their limited command of the language, and that they did not complete some of the activities as a result. This may be related to the above point regarding learners' independent use of the platform. As noted, teachers report that while they encouraged the learners to answer questions on their own, they "*never said no to any [request for] assistance [or] request and especially to the younger children*". The teachers, then, were hesitant about allowing young learners to grapple with problems independently. Learners who did not understand the language turned to the teachers for assistance, who in turn, did try to help to the best of their ability in explaining the written language. Ultimately, in the specific framework of the pilot's implementation, taking into account the teachers' active support of young learners facing language difficulties, those with low literacy did not utilize the software as well as their peers with higher literacy levels.

Connectivity and hardware: As previously mentioned, limited internet connectivity and insufficient hardware affected the learners' experience. Thus, when learners were not able to attend the center in Greece, for example, the result was a decreased ability and interest in the

platform. This had significant effects, as students ultimately stopped using the platform and learning transitioned to one-on-one communication via WhatsApp and house visits.

Tracking Progress: Teachers in both locations reported that the software was helpful in tracking the progress of the learners; that generating the information about individual progress was easy enough and that they did so on a regular basis, which assisted them in monitoring students' progress and difficulties.

Finally, some learners stated that the process of "winning planets" (moving from one level to the next) was too long, leading some to suggest that reducing the number of exercises required to move ahead, especially at the beginning, can have a positive effect on the engagement of the learners.

Conclusions & Recommendations

Mathika was perceived by most stakeholders as a useful math teaching platform as well as a potentially productive tool in a wider strategy of advancing children's digital education. It is emphasized that the conclusions pertain to using the software in a structured setting with supportive adult presence, and do not pertain to independent learning in humanitarian settings.

Many of the advantages of incorporating technology in education, in humanitarian settings, were evident in the pilot's implementation, as well as some of the obstacles. The use of *Mathika* one-hour per week in a structured program, with a teacher in place, over five months, can be valuable in helping young students acquire basic math skills. To a lesser extent, the pilot also provides an indication that use of the software in such frameworks can facilitate older students' acquisition of more advanced math skills. What further emerges is high satisfaction with the incorporation of technology in the classroom.

Mathika's curated learning allowed students to progress at their own pace – gradually more independently – and provided teachers with accurate feedback on students' progress. Using the software in a structured framework also helped to develop the students' motivation, confidence and resilience, in math specifically and in learning in general. Its approach to problem solving (for example, the in-game hints) was identified as conducive to building up motivation and a sense of self-efficacy.

At the same time, some of the barriers to effective utilization of technology that are mentioned in the literature were not fully overcome. Insufficient availability of appropriate internet connection and relevant hardware and lack of previous exposure to digital devices and consequent gaps are issues came to the fore during implementation.

Overall, it is our assessment that when integrating *Mathika* in an appropriate framework and

taking into account technological gaps and other contextual factors, the platform can indeed contribute to the promotion of "*inclusive and equitable quality education and promote lifelong opportunity for all." (SDG 4)*

Recommendations

- It is suggested to incorporate in the objectives of programs utilizing *Mathika* and comparable software, the enhancement of **digital education**, and not "only" improvement of math skills. In some contexts, the platform can provide an important contribution to reducing technological gaps and advancing digital education in underserved communities. Thus, while purchasing tablets for students may not be cost effective if an intervention is aimed strictly at closing specific gaps in math, it may be seen differently if part of a wider program introducing vulnerable children to a digital learning and work environment. This is essential also because, in many cases, formal school systems hardly address such gaps, often much less than formal math content.

- Consider integrating in future programs utilizing *Mathika* more **in-depth training, guidance and work with the teachers** involved, so as to realize added values of the software (e.g. independent learning, language). Such training should be approached as an important component of a program. It can include experiential learning, follow up sessions that will take place weeks into implementation and discussions of the teacher's role in supporting students while encouraging them to solve problems independently. The latter is important because of the non-standard teaching and strong emphasis on learners' self-experimentation envisioned by the platform's designers on the one hand, and the ingrained habits of teachers as well as their assessment of the needs of vulnerable children on the other hand.

- Consider ways to facilitate more effective **communication between the implementing teams and the software's developers**. This may include having a point-person on the ground, who will undergo training, maintain communication with the developers and provide guidance to peers as needed.

- Consider holding a **preparatory course** for learners on basic operation of laptops and tablets, as children in refugee settings may not have experience in operating the basic hardware (keyboard, mouse, touchscreen). That would allow students to delve directly into and focus on the contents.

- In migrant and refugee settings, there is a need for an **offline version** of the software, given the issues of limited and unreliable connectivity.

Bibliography

Ali, G., Haolader, F. A., & Muhammad, K. (2013). The role of ICT to make teaching-learning effective in higher institutions of learning in Uganda. International Journal of Innovative Research in Science, Engineering and Technology, 2(8), 4061-4073.

Ally, M. et al. (2017). Use of Tablet Computers to Improve Access to Education in a Remote Location. Journal of Learning for Development, 4(2), 221-228. Retrieved from http://ezproxy.lib.uconn.edu/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN= EJ1149172&site=ehost-live Daily Monitor. Primary school teachers fail Mathematics (no date). Retrieved 4 January 2019, from

https://www.monitor.co.ug/News/National/Primary-school-teachers-fail-Mathematics/688334-4318222-qhq njp/index.html

Sedig, K. (2008). From play to thoughtful Learning: A design strategy to engage children with mathematical representations Journal of Computers in Mathematics and Science Teaching, 27(1), 65-101.

Zakaria, N. A., & Khalid, F. (2016). The Benefits and Constraints of the Use of Information and Communication Technology (ICT) in Teaching Mathematics. Creative Education, Scientific Research Publishing, 7(11), 1537–1544. https://doi.org/10.4236/ce.2016.711158

Sung, Y.-T., Chang, K.-E., & Liu, T.-C. (2016). The effects of integrating mobile devices with teaching and learning on students' learning performance: A meta-analysis and research synthesis. Computers & Education, Pergamon, 94, 252-275.https://doi.org/10.1016/J.COMPEDU.2015.11.008 Tella, A. (2008). Teacher Variables As Predictors of Academic Achievement of Primary School Pupils

Mukiri Mwingirwa, I., & Khakasa Miheso-O' Connor, M. (2016). Status of Teachers' Technology Uptake and Use of GeoGebra in Teaching Secondary School Mathematics in Kenya. International Journal of Research in Education and Science (IJRES), 2(2), 286-294.

Musiimenta, A, Tumuhimbise, W, Nankunda, M, Bangumya, E, Atuhaire J, Mugonza, R, Kobutungi, P & Mugaba, A.T, (2019), Journal of Education and Development; Vol. 3, No. 2; August, 2019 ISSN 2529-7996 E-ISSN 2591-7250 Published by July Press