sami
Supporting African Maths Initiatives

Supporting African Maths Initiatives
(A company limited by guarantee)

Report and Financial Statements
for the year ended 28th February 2022

Charity number 1161994
Company number 9458921

Supporting African Maths Initiatives - Report of the Management Committee for the year ended 28th February 2022

The Management Committee presents their report and the financial statements for the period ended 28th February 2022 and confirm they comply with the requirements of the Charities Act 2011 and the Charities SORP (FRS 102).

Reference and Administration Information

Charity name: Supporting African Maths Initiatives
Charity registration number: 1161994
Company registration number: 9458921
Registered address: Haydown Great Buckland, Luddesdown, Gravesend, Kent, England, DA13 0XF

Management Committee

Executive Directors	*Non Executive Directors*
Mrs Emily Fleming (Chair)	Dr Franca Hoffmann
Mr Jeff Goodman	Prof Balázs Szendröi
Mr Chris Clarke	Dr Georg Osang
	Dr Danilo Lewanski

Other members

Alexandra Gessner	Giovanna De Giusti	Michela De Giusti
Amy Fletcher	Iordan Ganev	Monica Mancini
Anda Chisster	James Robson	Nicos Starreveld
Andrew Harris	Joanna De Silva	Oliver Dann
Artur Donaldson	Kelly Pickerill	Pafue Christy Nganjimi
Benjamin Walker	Lily Clements	Peter Hull
Danny Parsons	Livia Mitson	Rachel Knott
David Stern	Mairi Walker	Rafael Sanchez
Esmee te Winkel	Marc Jeannin	Rose Teague
Filippo Mancini	Marta Maggioni	Santiago Maria Borio
Gabriel Diaz-Aylwin	Matteo Levi	Peñaloza
Giacomo Bighin	Matteo Parisi	Sharad Keshari
Gianmarco Bet	Michal Rolinek	Tom Denton

Chair's report

With the continued challenges faced around the world by the ongoing global pandemic, SAMI's focus for 2021 was again on adaptation and innovation of our initiatives.

With some countries starting to slowly reduce restrictions, we were able to expand our virtual maths camps to include some hybrid in-person activities. We were also delighted to see the first 2000 packs of VMC playing cards printed and distributed, to be used alongside camp and club activities.

We continued our support for the innovative e-learning platform STACK by developing a large bank of formative assessment questions, and supported a number of training events to help people use them. We were also excited to see the resumption of some school visits for our Happy Classrooms initiative.

None of this would have been possible were it not for the time and energy of our amazing volunteers. We are so grateful to have such an incredible network of support and are hopeful that over the next year we will be able to start working together again, collaborating in person and in-country.

We are also incredibly thankful and heartened by the generosity of our donors, whose continued support has allowed us to enable these new approaches, and increase our reach and impact.

More information about SAMI and our initiatives can be found at www.samicharity.co.uk
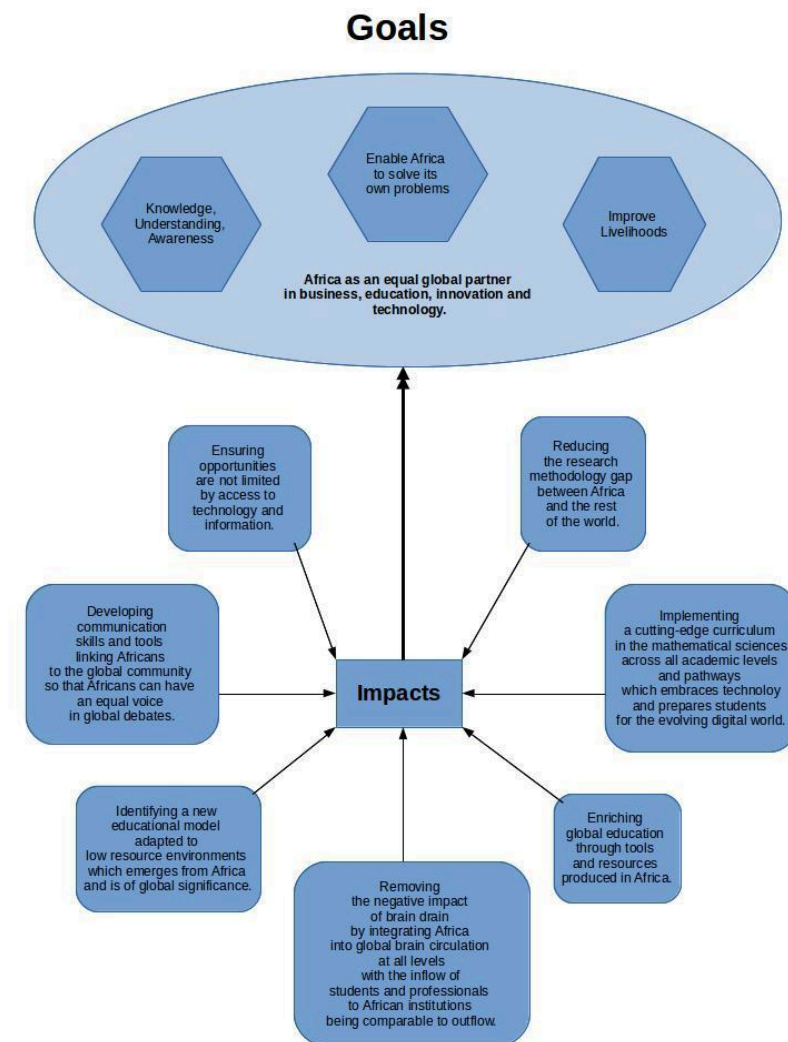
Emily Fleming
Chair
14 November 2022

Aims and Objectives

Our charity's objectives as set out in the company's memorandum of association are:

To advance education in mathematics for the public benefit, in particular but not exclusively by
a) supporting initiatives that promote mathematics and improve the standard of mathematics education in Africa through the provision of advice, funding, consultancy services and volunteers designed to support such initiatives;
b) carrying out research into the effectiveness of new teaching and learning initiatives in mathematics, the useful results of which will be disseminated for public benefit.

Our aims as a charity can be summarised by the following infographic:

Goals

Knowledge, Understanding, Awareness

Enable Africa to solve its own problems

Improve Livelihoods

Africa as an equal global partner in business, education, innovation and technology.

Ensuring opportunities are not limited by access to technology and information.

Reducing the research methodology gap between Africa and the rest of the world.

Developing communication skills and tools linking Africans to the global community so that Africans can have an equal voice in global debates.

Impacts

Implementing a cutting-edge curriculum in the mathematical sciences across all academic levels and pathways which embraces technoloy and prepares students for the evolving digital world.

Identifying a new educational model adapted to low resource environments which emerges from Africa and is of global significance.

Removing the negative impact of brain drain by integrating Africa into global brain circulation at all levels with the inflow of students and professionals to African institutions being comparable to outflow.

Enriching global education through tools and resources produced in Africa.

Updates from Initiatives

Virtual Maths Camps (VMC)

Virtual Maths Camps were held in Kenya and Ethiopia in April each with its own unique way of bringing students together. These camps were followed by in-person events in Togo, Kenya and Tanzania.

Kenya April 2021

In Kenya, the entire event was held via Zoom and Telegram. Volunteers from the US and the UK were able to join in and deliver activity sessions for this 5-day long event. On the final day, a virtual treasure hunt took place amongst the participants via a puzzle challenge using SAMI's Virtual Maths Camp Chatbot. This was the second virtual maths camp event held in Kenya with 30 participants from 14 different high schools able to attend.

Ethiopia April 2021

Given the current political climate in Ethiopia, it was impossible to organise an in-person event and with regular government Internet outages, Zoom was not a feasible option. Nonetheless, the team persevered and organised a one-of-a-kind event – an entire camp solely done via text messaging. Despite the challenges involved, the camp was a great success. Telegram was the platform for the event and the team made use of the puzzle-based Chatbot text messaging service developed by one of our SAMI directors. 40 students, 5 teachers and 12 volunteers participated in the camp.

Togo August 2021

With SAMI's support, Kossi Aamouzouvi was able to lead a team of volunteers to organise a maths camp concurrently in three different towns with a total of 73 students. It was a real success and the SAMI playing cards were used to great effect. The directors of the students' schools were all amazed by the program and motivated the volunteers to carry on this initiative to other schools as well. The Director of the school in Klikame - Lome, was inspired to create a maths club in his school. The participants spent a wonderful three days in a playful mathematics environment.

Kenya Kongoni October 2021

The Kongoni Community Library (KCL) in Kakamega County, hosted an in-person maths camp in October 2021. The library serves as a community learning drop-in centre for both students and adults and is run by volunteer high school graduates and maintained by donor funding.

The October Maths Camp attracted 32 students from eight secondary schools. The participants were between the ages of fifteen and twenty-two. A total of ten local volunteers planned and delivered the camp with two international volunteers joining remotely. A maths club at the Lycee Francais Charles de Gaulle school in London also joined remotely on Wednesday. Games and puzzles, data literacy, mathematical thinking, research, physical activities, simulations and GeoGebra were among the themes explored during the camp. Students were all given a pack of SAMI playing cards and shown how to make the best use of the games, puzzles and activities.

Tanzania Camp December 2021

S.T.E.M. Boot Camp is a long-term initiative targeted at combining project-based learning and integrated learning to enrich the science and mathematics curriculum in secondary schools. This aims to unlock students' potential by involving them in integrating classroom lessons into projects as a means of increasing the quality of education and, as a result, the value of secondary school graduates. A total of 10 volunteers planned for the sessions, including the team from Kenya supported by SAMI, and facilitated the sessions at the STEM Park, Tanga City.

The goal of the camp was to encourage students to get involved in STEM fields by giving them the opportunity to learn about different career paths and develop an interest in the field, as well as sparking their creativity and research skills, resulting in job creation and poverty alleviation in Tanzania. The students were free to select among activities in S.T.E.M (Science, Technology, Engineering and Mathematics) sessions at the camp according to their interests. The camp's theme was "Enabling access to health services in the digital era".

Big data and data analysis were the themes of the 2021 math class. The students were introduced to the various aspects of working with data and their significance. Students had the opportunity to explore their interest in entering data, examining data displays, collecting data, analyzing data using various applications, discovering data such as disease modelling, and solving problems with data throughout the week.

Playing Cards

SAMI has completed the production of our Virtual Maths Camp card decks. Each of the 54 cards in the deck features a unique mathematical activity, engaging students in games, puzzles or fun mathematical facts. A leaflet gives hints and answers, whereas a QR code leads from each card to a website that contains extensions and references. A chatbot function is also available to check solutions. The card deck will provide an almost endless source of entertainment to a group of students aged 12-18 who are eager to engage with mathematics.

The first batch of playing cards were printed in Hungary at the start of 2021. A huge thanks to Balázs Szendrői for organising the printing and subsequent distribution of the cards. This year the cards have been distributed to our partners in many countries for use in their virtual and face-to-face Maths Camps. Card Decks have so far been shipped to our partners Bahir Dar University in Ethiopia, SAMI Ghana, as well as to Benin and Togo. A separate printing operation was carried out to produce decks for AMI in Kenya.

Togo maths club activities

To celebrate International Day of Women and Girls in Science Day (11 February), Kossi organised a maths club activity using the 7 of Hearts from the playing cards deck. The activity was delivered to a group of 30 young students and was facilitated by Kossi and two other volunteers. In the activity session, they remembered astronauts Valentina Vladimirovna Tereshkova and Mae Carol Jemison, the first black woman in space.

R-Instat Code Sprint

Roger Stern and Danny Parsons organised an R-Instat "code sprint" from 6-10 September where there was a push on development with a specific objective of making R-Instat more suitable for "making data science easy", partly in preparation for an upcoming AIMS Cameroon course but also generally, as Data Science is something that is only going to be become more and more popular and in demand over time.

Ideally, everyone would have been together in Kenya for this event but international travel was still too difficult. However, SAMI was able to support the Kenya team (through the Honorarium donation) to get together to make it a much more productive week, with just the international team joining remotely. SAMI paid for the accommodation and food in Kakamega for 12 people for the week.

Supporting AMI work

SAMI has again worked closely this year with the Kenyan NGO African Maths Initiatives (AMI), especially enjoying supporting the team to get back to face-to-face interactions with learners.

The AMI team have had a very busy year running the camps mentioned above as well as the initiatives detailed below which come under the broad heading of "Enhancing Maths Education in Primary, Secondary and University Levels".

Financial support for AMI team members Samuel Okoth, Feleria Adinda, Christine Laetitia Agola and Juma Zevick Otieno has come from Lars Foundation.

SAMI does not provide any financial support to Zach Mbasu but greatly values his leadership when partnering on projects with Innodems and AMI.

SAMI and AMI were joined virtually from January 2021 to September 2021 by Dan Kelly - a school leaver who chose to volunteer for SAMI during his gap year waiting to attend Oxford University. Dan wrote problems for the SAMI Maths Club app, designed and created a pause-and-go video, planned sessions for the virtual maths camp, reviewed lessons for Happy Classrooms and then spent the majority of his time learning how to author STACK questions and creating a bank of resources to use in Kenya and the UK. His dedication to SAMI was impressive and much appreciated.

Maths Clubs

The AMI team have enjoyed being able to visit schools in person this year, inspiring teachers to set up or improve maths clubs and running sessions with students. A particular highlight was follow-up training at Kongoni Community Library after the Maths Camp. Matunda Secondary School stood out, reporting an innovative approach of printing the weekly problems from the VMC cards ahead of their Thursday meetings and posting them in the classrooms for all students to access, whether or not they were members of the Maths Club. The school's Math Club now has 500 students!!

STACK

SAMI has continued to support the development of online formative maths questions using software called STACK.

STACK has huge advantages over other online assessment systems as it was particularly defined for formative assessment and the questions are specifically written to detect common misconceptions and give automatic relevant feedback to students. Also, students can attempt quizzes multiple times with new variations of questions generated with each new try. Finally, STACK has the potential to ask open questions that help students develop higher-order skills, for example, questions where students have to create their own examples for specific situations.

Throughout the year SAMI, AMI and Innodems have worked together to train a team of question writers and have created a bank of questions to be used in schools.

Happy Classrooms

The easing of lockdown finally meant that AMI could relaunch the painting of primary school classrooms in Kenya with the funds raised last year. In total 13 Grade 1 and Grade 2 classrooms were painted in the following 9 schools:

Wekhonye Primary School
Shivanga Primary School
Vashele Primary School
Cheptuli Primary School
Nyarongi Primary School
Kongoni Primary School
CCM Mbuinjeru Primary School
Ketiplong Primary School
St. Lawrence Ichina Primary School

In each school the teachers were given support resources including model lessons plans and follow up visits were carried out to help teachers make the most of the engaging designs on the walls.

Fundraising

SAMI has been fortunate to receive donations and raise money in many varied ways this year. Special mention goes to Marc Jeannin for continuing support with monthly donations and his donation to cover the governance fee this year. One of SAMI's non-executive directors, Danilo Lewanski secured a grant for maths educational projects in Africa. The name of his project is EnTIRe (Enumerative Topological recursion, Integrability, and Resurgence). Danilo proposed it to the Swiss National Science Foundation for the period 2021 - 2025, it has one million CHF funding for the establishment of his own research group at the University of Geneva, of which 40.000 CHF were granted for maths educational projects in Africa. This funding has meant that Danilo has been able to fund and extend projects instead of SAMI.

Virtual Maths Camp

We have received many kind donations for our Virtual Maths Camp project which has now thankfully merged into hybrid and fully in person camps. A fundraiser at the Lycee Francais Charles de Gaulle led by Emily Fleming and Jeff Goodman with lots of help from their students Etienne Royer-Gray and Eleanor Russel raised £1415 to put towards the Virtual Maths Camps. In this financial year, Etienne has also fundraised in advance of an attempt at the London Marathon in October 2022 for SAMI.

LARS Foundation

We have continued to benefit from the £10,000 of unrestricted funds which Lars donated to us last year and are extremely happy that they have pledged to do the same again next year.

Honorarium from AIMS Cameroon

Roger Stern and Danny Parsons have taught statistics courses and supervised students at AIMS Cameroon over the last few years and received an honorarium for doing so. They have very generously donated this money for the second year in a row to SAMI. They have given £1512 to SAMI to be used to support the Kenya team and others in activities such as workshops, courses and conferences

SAMI continues to be supported both financially and through consultancy support from the community interest company IDEMS.

IDEMS has a legal relationship with SAMI. SAMI is mentioned in IDEMS Articles of Association as a specified organisation which IDEMS is able to transfer assets (including money) within its requirements as a community interest company. IDEMS made a donation of £410 to SAMI in 2021/22.

Structure, governance and management

Governing document

SAMI is a charitable company limited by guarantee, incorporated on the 25th of February 2015 and registered as a charity on the 3rd of June 2015.

The company was established under a Memorandum of Association by which it is governed in addition to its Articles of Association, dated 13th of May.

Appointment of Trustees

One-third of the trustees of SAMI stands down at the following year's AGM. Members and supporters of SAMI are written to in advance of the meeting to ask if anyone would like to be a trustee. New trustees are voted in at the AGM, and trustee positions may include previous trustees if there is no one else who would like to take over.

Organisation

The board of trustees, with a lot of help from other members, administers the charity. Trustees meet regularly throughout the year, and formally on at least three occasions.

Currently, all members are voting members.

Related parties and cooperation with other organisations

Before its incorporation, SAMI was set up after teachers helped at one of the maths camps in Kenya and wanted to extend the good work that was being done by AMI. AMI is a Kenyan NGO that SAMI continues to work with very closely. SAMI and AMI collaborate together on activities and make payments on behalf of each other in the appropriate countries.

Financial Review

We don't have premises to run or any overheads, but we are committed to keeping a core set of projects running in Kenya and partner countries. At present, there is no separate reserve fund in place as our reserves are held as unrestricted funds. In line with our policy, we aim to ensure that the unrestricted funds do not fall below £2500.

Reserves can be allocated to charitable activities at the end of the financial year if the reserves are above the amount outlined. Reserves may only be used in exceptional circumstances if all executive directors agree.

This policy is reviewed on an annual basis at the time of our annual report.

Our policies require that requests for funding of projects come in writing and any expenditure must be approved by the Trustees. These requests are reviewed in line with our objectives, our current financial situation and our risk management policy. The Trustees assess the likely risks to which the charity is exposed, in particular including those related to the operations and finances of the charity, and are satisfied that systems are in place to mitigate our exposure to the major risks.

Statement of financial activities

Statement of financial activities (incorporating Income and Expenditure account)
For the period ended 28th February 2022.

Income

	Unrestricted funds (£)	Restricted funds (£)	Total 2022 (£)	Total 2021 (£)
Donations				
Personal fundraising and donations	2,160	-	2,160	4,803
Benevity donation	-	-	-	295
IDEMS	410	-	410	110
IDEMS donation for Cross Pollination	-	-	-	1,890
IDEMS donation for Cameroon	-	-	-	900
Virtual Maths Camp	-	1,750	1,750	7,149
Happy Classrooms	-	-	-	1,322
Global giving foundation	180	-	180	-
Sam Hyatt-Twynam	-	-	-	5,000
Jeff Snyder	-	-	-	3,740
Lars	-	-	-	10,000
Honorarium from AIMS Cameroon		1,512	1,512	3,459
Charitable activities				
Pi Day from 2020	50		50	50

Income continued

	Unrestricted funds (£)	Restricted funds (£)	Total 2022 (£)	Total 2021 (£)
Other trading activities				
Donations for used corks and cartridges	71	-	71	81
Using EasyFundraising online	234	-	234	59
Paypal Giving Fund	16	-	16	97
Amazon Smile	72	-	72	43
Charitable Giving	-	-	-	184
Total incoming resources	3,193	3,262	6,455	39,444

Expenditure

	Unrestricted funds (£)	Restricted funds (£)	Total 2022 (£)	Total 2021 (£)
Cost of generating funds				
Posting corks	6	-	6	-
Audit	600	-	600	-
Communications	-	-	-	750
Charitable activities				
Virtual Maths Camps	-	3,808	3,808	1,128
Supporting AMI work	6,014	-	6,014	2,926
Happy Classrooms		1,747	1,747	68
Sam Hyatt-Twynam		1,843	1,843	3,138
Honorarium AIMS Cameroon		1,430	1,430	-

Expenditure continued

	Unrestricted funds (£)	Restricted funds (£)	Total 2022 (£)	Total 2021 (£)
Maths Club Togo	60	-	60	-
Online Togo	-	-	-	267
Cameroon	-	-	-	899
Stats4sd	-	-	-	1,588
Cross Pollination	-	-	-	328
SAMI App	-	-	-	910
Jeff Snyder	-	2,000	2,000	-
Governance costs - companies house registration	388	-	388	13
Total expended resources	7,068	10,828	17,896	12,015

	Unrestricted funds (£)	Restricted funds (£)	Total 2022 (£)	Total 2021 (£)
Net income/expenditure and net movement in funds	-3,875	-7,566	-11,441	27,429
Funds brought forward	12,129	24,309	36,438	9,009
Funds carried forward	8,254	16,743	24,997	36,438

Balance Sheet as of 28th February 2022

	Unrestricted funds (£)	Restricted funds (£)	Total funds 2022 (£)	Total funds 2021(£)
Current assets:				
Debtors	-	-	-	-
Cash at bank and in hand	8,254	16,743	24,997	36,438
Total current assets	8,254	16,743	24,997	36,438
Creditors: Amounts falling due within one year	-	-	-	-
Net current assets or liabilities	8,254	16,743	24,997	36,438
Total net assets	8,254	16,743	24,997	36,438
Reserves				
Unrestricted funds			8,254	12,129
Restricted funds			16,743	24,309
			24,997	36,438

For the period ended 28 February 2022 the company was entitled to an exemption from the requirement to have an audit under the provisions of section 477 of the Companies Act 2006. No notice has been deposited with the company under section 476 of the Companies Act 2006 requiring an audit to be carried out.

The directors acknowledge their responsibility for:

(i) ensuring the company keeps accounting records which comply with sections 386 and 387 of the Companies Act 2006; and
(ii) preparing financial statements which give a true and fair view of the state of affairs of the company as at the end of the financial year, and of its surplus or deficit for that financial year in accordance with the requirements of sections 394 and 395 of the Companies Act 2006.

These accounts have been prepared in accordance with the provisions applicable to charitable companies subject to the small companies regime within Part 15 of the Companies Act 2006 and the Financial Reporting Standard for Smaller Entities (effective January 2019).

Approved and authorised for issue by the Directors on 14th of November 2022 and signed on their behalf by:

Signed: Signed:

Name: Emily Fleming (director)   Name: Jeff Goodman (director)

Notes to the Accounts

For the period ended 28 February 2022

1. Accounting policies

Basis of Accounting

The charitable company is a public benefit entity under F*RS 102. The* financial statements have been prepared under the historical cost convention. They are in accordance with accepting accounting standards in the United Kingdom and comply with the provisions of The Charities Act 2011 and Reporting by Charities: Statement of Recommended Practice applicable to charities preparing their accounts in accordance with the Charities SORP (FRS 102).

Income Recognition

Donations and other income are accounted for when receivable by the charity. Investment income including bank interest is accounted for on an accrual basis.

Expenditure Recognition

The charity is not registered for VAT and accordingly expenditure is gross of irrecoverable VAT.

Charitable expenditure comprises donations to beneficiaries and related administration costs. Donations to beneficiaries are recognised when a constructive obligation arises that result in the payment being unavoidable.

Governance costs include those costs associated with meeting the constitutional and statutory requirements of the charity and include the costs linked to the strategic management of the charity.

Funds held by the charity are:

Unrestricted funds
These are the funds that can be used in accordance with the charitable objectives at the discretion of the directors.

Restricted funds

These can be funds that can only be used for particular restricted purposes within the objectives of the charity. Restrictions arise when specified by the donor or when funds are raised for particular restricted purposes.

2. Breakdown of expenditure on Charitable Activities

Expenditure (Unrestricted)	Supporting AMI work (£)	Maths Club Togo (£)	Total (£)
Costs directly allocated to Charitable activities			
Stipends	5,167	-	5,167
Internet	452	-	452
Technology	285	-	285
Travel	29	56	85
Support costs allocated to Charitable activities			
Foreign transfer bank fees	81	4	85
Total expended funds (unrestricted)	6,014	60	6,074

3. Breakdown of expenditure on Charitable Activities (continued)

Expenditure (Restricted)	Virtual Maths Camps (£)	Happy Classrooms (£)	Sam Hyatt-Twynam (£)	Honorarium AIMS Cameroon (£)	Jeff Snyder (£)	Total (£)
Costs directly allocated to Charitable activities						
Stipends			1,805			1,805
Travel for volunteers for maths camps	668					668
Food, accommodation, transport, equipment hire and resources for students and local teachers for a camp or "code sprint"	833			1,408		2,241
Printing and posting SAMI playing cards	2,012				2,000	4,012
Internet and call credits	243					243
Labour, transport and supplies for Happy Classrooms		1,719				1,719
Support costs allocated to Charitable activities						
Bank charges	52	28	38	22		140
Total expended funds (restricted)	3,808	1,747	1,843	1,430	2,000	10,828

3. Funds

	At 28 Feb 2021	Income	Expenditure	At 28 Feb 2022
Unrestricted funds				
General funds	12,129	3,193	(7,068)	8,254
Total unrestricted	12,129	3,193	(7,068)	8,254
Restricted funds				
Virtual Maths Camp	6,021	1,750	(3,808)	3,963
Jeff Snyder	3,740	0	(2,000)	1,740
Sam Hyatt-Twynam	5,308	0	(1,843)	3,465
Happy Classrooms	3,281	0	(1,747)	1,534
Honorarium from AIMS Cameroon	3,459	1,512	(1,430)	3,541
Argus	2,500	0	(0)	2500
Total restricted	24,309	3,262	(15,068)	16,743
Total funds	£36,438	£6,455	£(17,896)	£24,997

Details of restricted funds

Virtual Maths Camps
Funds raised to continue to provide a maths camp experience for students, teachers, and facilitators from across the globe - in a new, dynamic, partially virtual and fully international environment.

Jeff Snyder
Jeff Snyder kindly chose SAMI to receive a grant through his company PDT Partners.

Sam Hyatt-Twynam
Donation received to improve maths education in Kenya through teachers.

Happy Classrooms

Funds raised to paint classrooms and train teachers to use the new resources.

Honorarium from AIMS Cameroon

Funds donated by Roger Stern and Danny Parsons to fund activities such as workshops, courses and conferences

4. Trustee Remuneration

None of the directors (trustees) received remuneration or expenses during the period.

5. Average Number of Employees

The average number of employees during the year was Nil (2020 – Nil)

6. Related Party Disclosures

There have been no transactions with related parties in the year to 28 February 2022.

Appendix 1

Explanation of keywords and phrases used in the infographic

- All academic levels – primary school all the way up to PhD and beyond. If activities are not designed with the scope of creating PhD holders then whatever change is attempted lower down (e.g. primary schools) could be undermined by people with higher qualifications but less knowledge.
- All pathways – maths for mathematicians, maths for scientists, maths literacy, vocational, other professions and walks of life. This is very important as a concept because most people specialise, but particularly in the African context, it is important and constructive to see this as a whole. We won't be constrained by thinking about one particular strain, we can turn this into an advantage and perhaps Africa can become an equal partner by taking on some of these bigger-picture solutions because everyone else is looking at a smaller level.
- Brain drain – The intellectual elite are integrating and migrating into the global system due to better pay and employment opportunities, however in developing countries, the local system cannot afford to lose them. (In some small countries, losing individuals as a result of brain drain is a problem. For example, in the case of Madagascar, graduates did not want to return to their country as they would face academic isolation. Alternatively, when individuals do not leave this can result in people developing in isolation, which can also be problematic. In some instances brain drain can be beneficial, as those individuals who choose to return after going away share their knowledge and skills with the local population.)
- Brain circulation – There is a need to improve the system by improving the circulation of people into the system, there are opportunities for dynamic individuals.
- Low resource environment - aims to dispel the myth that low resource environment means no access to technology, problem solving, extra curricular. Many low resource environments have time in abundance to do extra activities. Thinking about Kenya and South Africa, there are large chunks of the school day where pupils are waiting or simply having their time filled without much of an educational purpose. There is no way to create enough good skilled teachers to have a good teacher to pupil ratio. That is the essence of a low resource environment. But this lends itself to technology based approaches. At some stage the technology will need to be a tool to help pupil based learning activities. Modern day technology can now provide feedback which is the revelation. A myth of low resource environment is

that there is no funding. But actually governments do invest in education, but often the money is not spent wisely. The maths camp in Maseno in 2014 broke even on local funds. Another myth is that extra-curricular is a luxury, but it is actually easy and does exist in Africa.

- Educational model - The concepts, ideals and values behind the educational system. A model that has the values of formative assessment and feedback. An educational model encompasses concepts, the what and the why, the role of school, the aim of education, the teacher-student role. The educational model stands for the concepts without the implementation. Research methodology gap - The research methods used throughout Africa for most areas of research from universities to professionals are the same methods as were used in the 1960s. Now we have big data and large data sets. People in e.g. Agriculture and medicine, are taught statistics as a service subject. Tools they are taught and the tools that are available are from the 1960s. There has been an explosion in tools and data that are available. These make the research much easier.The tools used by global research are growing exponentially. The gap in terms of the methodologies used has been getting worse and worse. Difficult to overstate the size of this problem. Pretty much all the money spent on agricultural research in Africa is wasted due to this problem.

Appendix 2

Underlying Dimensions: Situational constraints and choices

Before considering how we hope to move towards the high level outcomes via a lower tier of activities, outputs and outcomes it is important to discuss some of the dimensions that may constrain or guide us. We will start by discussing those we view as imposed by choosing to work in an African context and can be chosen to be seen from positive or negative perspectives.

Young/Old Demographic
Africa has the world's youngest population which could be its greatest asset or greatest threat. For example, we could not begin to think that in the future there will be anywhere near enough highly trained and skilled teachers to teach all of Africa's youth, and therefore we cannot consider anything that would depend on this fact.

Individuals/Institutions
Individuals have large amounts of responsibility and influence. They can really make a difference. This has some clear negative connotations when considering issues such as corruption, however this can also be turned into a strength given the ability for these individuals to provide information and communicate between a much wider target audience. An example might be the importance of formative feedback being pushed within school and university contexts by the same small groups of individuals who have a great deal of influence within both contexts.

Demand/Supply-Driven Change
Change is driven by demand. There is potential for large-scale systematic reforms.

Low/High Resource Environments
Working in low resource environments is challenging, but has the potential to impact universally.
One might argue that the diversity of Africa does indeed provide a number of high resource environments (strong-performing private schools for example, akin to many of those in Western countries), however we could not possibly feel justified focusing within this specific domain and claiming it representative of wider Africa. It is clear by example that if you were to create a set of resources that helped young children fundamentally grasp concepts through 1:1 student-teacher interactions, this model could not then be transferred into a situation where the ratio may in fact be 1:50. If however we take the converse and find

something that works within a 1:50 environment then it will hold many of the same benefits when implemented back in our initial high resource environment.

Whilst the previous dimensional *choices* are already made through the decision to work within the wider African context, there are still numerous further dimensions where choices have to be made. We have identified the following 4 pairs as significant for what we want to achieve:

Top-down Bottom up
Adaptive Disruptive

Formal Informal

Content Implementation

These dimensions all have the ability to drastically change the appearance and nature of an initiative. If we were to just take 2 we could represent such choices and outcomes by the following diagram:

	Adaptive	Disruptive
Formal	Improving current school curricula to include problem solving	Completely replacing current school curricula to take a different approach
Informal	Build on existing community literacy programs	Create a new set of microworlds that enable education to become a core component of daily life

We would assert that when considering how to move in the direction of our proposed outcomes, it is important to consider how it is possible to provide progress across all dimensions in which we have choices; from grassroots initiatives to government-backed schemes, building on work which has already been done, as well as bringing in completely fresh and new ideas, influencing within defined instructional institutions as well as

anywhere else learning can take place. We could see how these different approaches could all potentially add value and move towards a specific long term outcome.

Appendix 3

Key values

- Sustainability: From its inception, the first maths camp - the Maseno Maths Camp - was an initiative instigated and supported by lecturers at Maseno University as a locally sustainable initiative. All camps are not-for-profit ventures, with local and international educators volunteering their time freely. In 2014, the Maseno Maths Camp was able to run with all local expenses covered by student registration fees. Full fees for the week including accommodation and food are 5000 Kenyan Shillings (around $60) with a large number of local students paying reduced fees. There is a similar scenario in the Ghana maths camp, and in Ethiopia the students are funded from the university budget. Volunteers at the camps include a mix of local and international mathematics students, teachers, educators, lecturers, academics, researchers, PhD students and mathematics enthusiasts, a mix designed to maintain engagement of participants whilst ensuring that the event does not rely on any given individual. Exceptional participants are encouraged to become volunteers and are mentored into a new role once they finish school.

- Extra-curricular mathematics: The camps are designed to open students' eyes to the world of mathematics and show that mathematics is not all about calculations. The aim is to introduce mathematics not found in a classroom, both through the choice of content and through the delivery of the subject material. Each camp focuses on five or six different "themes" in mathematics, such as modelling, combinatorics, programming, code breaking, statistics, non-Euclidean geometry and game theory. Whatever the theme, the focus is on understanding concepts and problem solving situations, very different from the calculation and formula emphasis students experience at school. Moreover, the organisers believe in making high level mathematics accessible to high school students. Even though the camps are not tailored to help students with the mathematics covered in the school curriculum, students often find that their achievements in mathematics improve on their return to school, and even see improvements in other subjects. The case studies of Cabrine and Evans, in our research paper for EDULEARN, illustrate this point even if they are exceptional rather than representative students.

- Inclusive: All high school students (aged roughly 14 to 18) are welcome to attend the camps. There are no entry requirements and the camps aim to have a mix of pupils with different socio-economic backgrounds and different achievements so far in maths. Equal numbers of boys and girls at the camps is a target, with a good mix every year so far, and there is a maximum number of students from any one individual school to ensure that a variety of schools are represented. Many students come from local public schools, but private and national schools are also represented. Students are not separated by any of these factors during sessions at

the camps and despite the wide range in ages, schools, backgrounds and mathematical ability of students who attend the camps, this has never caused an issue. The focus at the camps is not on the facts and formulas memorised in school but on critical thinking, creativity and being logical and persistent in solving puzzles and problems, so any student can succeed at the camp by applying themselves.

- Everyone Learns: The camp is set up to allow learning opportunities for everyone, not just the students attending. Local university student volunteers learn ideas applicable to their university maths clubs and get valuable new input to their studies. They meet and work alongside local and international lecturers, teachers and PhD students and integrate themselves into a wider professional network. Teachers who accompany their students are given a few separate sessions to discuss what they have observed and learned from the sessions, how they could take this back to their classrooms and how they can receive support from the organisers in doing so. In general, teachers attend the sessions together with the students and learn alongside them. Local and international teachers have the opportunity to interact with mathematics lecturers and researchers and learn new academic depth and background to the material they teach at school level. Local lecturers and teachers see a different style of teaching in action. Volunteers learn new branches of mathematics from being involved in a dynamic group with different specialisms. Mathematics researchers gain hands-on teaching experience alongside experienced teachers and receive feedback on their input. Thanks to this sharing of expertise across all levels the maths camps have been attracting enthusiastic and skilled volunteers consistently over the years, facilitating the smooth running of the camps.

- Technology: Technology plays a key role in the camps. Software such as Geogebra and Scratch are used to give students an opportunity to explore mathematics and programming in an interactive environment. Many students have not used a computer before; but rather than teach them how to use a computer, mathematical activities are designed which will allow them to learn how the computer works at the same time as doing the maths. Whenever possible free open source software is used and all the resources that the students are exposed to are given to them at the end of the week on a DVD.

- Development of New Educational Material: Each camp week is preceded by a preparation week where local and international organisers and volunteers get together to prepare the maths camp. This model has proven to be very successful given the challenge of organising such an event with facilitators being engaged in other full-time work both locally and abroad. The preparation week does not only serve as a training for local and international volunteers and as important team building in preparation for the camp week, allowing to share expertise, to learn new mathematics and to explore new teaching methods, it is also a valuable opportunity

to create new educational material. This is where new ideas and concepts are developed and tested with local and international partners working together on a tight deadline. Since 2011 a large number of resources have been created, both within and outside the preparation week, that are now more widely available. A secondary aim of the preparation week, in the last few years, has been to develop and improve the Maths Camp Starter Pack, a collection of mathematics resources that can be used by students, teachers, academics and interested individuals to run a similar event independently, be it for a half-day or a full week.

- Immersive environment: Students are immersed in mathematics throughout the whole week. The structure of the camp is designed to make time for physical activities and card games. Links between card games and mathematics are highlighted and physical activities are chosen carefully to involve teamwork, critical thinking and logic. It is a core belief of the camps that mathematics can be learnt through games. Students work in pairs and groups throughout the week to encourage mathematical discussion. There are puzzles of the day which students work on during their free time, and the computer labs are open outside formal sessions so that students are given the opportunity to explore the programmes they have been introduced to independently.

- Community: Students enjoy the opportunity to meet peers from other schools and to interact with local and international students, teachers, lecturers and researchers. Breakfasts, lunches and dinners are all taken together; these and other activities outside of lessons create a good working relationship between all camp participants. They help create an environment that breaks through the traditional hierarchies in educational institutions and gives mental space for critical thinking, allowing to challenge each other and learn from each other across all academic levels and backgrounds. A key value of the camps is that there are no barriers between students and facilitators, there are interactions between everyone and everyone has a voice. This sense of community builds with a few students returning year after year, in some cases even becoming volunteers after they leave school. Students are keen to share what they have learned on their return home, and almost universally state an enjoyment of mathematics when leaving the camp. This is a small but important step towards creating a community of individuals enthusiastic about mathematical ideas, and eager to embrace mathematical concepts in their future endeavours.