

## **Supporting African Maths Initiatives**

(A company limited by guarantee)

### **Report and Financial Statements for the year ended 28th February 2019**

Charity number 1161994

Company number 9458921

## Chair's report

We are extremely proud of all of our volunteers and partners who have helped extend our outreach during our fourth year as an incorporated charity. We have been able to sustain and grow the number of Maths Camps and help support new projects.

We are once again delighted to work closely with Zach Mbasu and Francis Trogor who have been instrumental in expanding our outreach in Kenya and Ghana, respectively.

For those who have contributed to our financial support, we remain extremely grateful. We were particularly thankful to Erin Bastian who competed in the London Marathon using SAMI's first ever charity place at the event. Another thank you is owed to St. Peter's College Oxford for their generous support both in hosting a fundraising event and in sponsoring students to join the Maths Camps.

More information can be found at [www.samicharity.co.uk](http://www.samicharity.co.uk).

Jeff Goodman  
Chair

# Supporting African Maths Initiatives - Report of the Management Committee for the year ended 28th February 2019

The Management Committee presents their report and the financial statements for the period ended 28th February 2019 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: Flat 3, 214 Bermondsey Street, SE1 3TQ

## Management Committee

### *Executive Directors*

Mrs Emily Fleming

Mr Jeff Goodman                      Chair

Mr Chris Clarke

### *Non Executive Directors*

Miss Franca Hoffmann

Prof Balazs Szendroi

### *Other members*

Mr Rafael Sanchez Bailo

Mr Santiago Borio Penaloza

Miss Mairi Walker

Mr Andrew Harris

Mrs Jo De Silva

Miss Amy Fletcher

Miss Michela De Giusti

Miss Rosemary Teague

Miss Anda Chisster

Mr Danny Parsons

Mr Tom Denton

Mr Benjamin Walker

Mr Jordan Ganey

Miss Kelly Pickerill

Miss Lily Clements  
Mr Michael Rolinek  
Mr Marc Jeannin  
Mr Filippo Mancini  
Miss Monica Mancini  
Mr Georg Osang  
Mr Gianmarco Bet  
Mr James Robson  
Miss Esmee te Winkel  
Miss Livia Mitson  
Miss Rachel Knott  
Mr Artur Donaldson  
Ms Marta Maggioni  
Mr Danilo Lewanski  
Ms Giovanna de Giusti  
Mr Oliver Dann

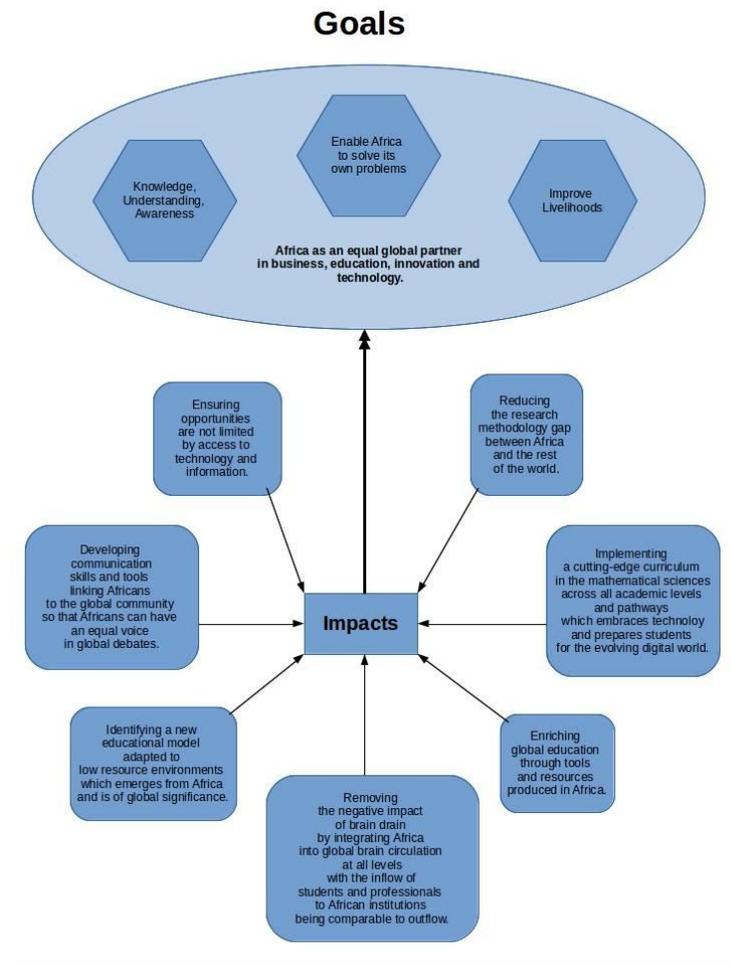
# Aims and Objectives

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:



## Ensuring our activities meet our aims and objectives

We review our activities three times a year using a system called Objective and Key Results (OKRs). We have an overriding working document evolving into a “Theory of Change” which is helping to guide our work and ensure that we are working towards our aims. We have referred to the guidance contained in the Charity Commission’s general guidance on public benefit when reviewing our aims and objectives and in planning our future activities. In particular the trustees consider how planned activities will contribute to the aims and objectives they have set.

## Activities

All our activities focus on working towards the aims and objectives outlined above and are undertaken to further our charitable purposes for the public benefit.

### Maths Camps in Africa

SAMI helps run maths camps in the summer in various countries in Africa. The first camp was held in 2011 in Kenya and the initiative has spread to Ethiopia, Ghana and Tanzania. Participation in the maths camps by teachers from the UK led to the creation of SAMI. SAMI now helps with raising funds, recruitment of volunteers and resources creation.

#### Purpose of the maths camps

During the maths camps, the focus is not on facts and formulas memorised in school but on critical thinking, teamwork and creativity, on being logical and persistent in solving puzzles and problems, and giving every student a chance to apply themselves. Rather than aiming to teach content, our goal is to inspire students, awakening their enthusiasm in mathematics by stimulating their natural curiosity. This can best be achieved through a 'learning by doing' approach, making sure students actively participate in the classes through activities and games. Since 2011 a large number of resources have been created that are now more widely available for free for the public benefit. These include guided activities for use in schools and university for student-led or facilitator-led maths clubs. The maths camps have shown that students' perception of mathematics can change significantly over the course of just a few days, and the gain in self-confidence and enthusiasm has helped students improve their results across subjects in the long-run.

The camps have been highly successful in part due to their key values: sustainability, teaching extra-curricular maths, being inclusive, creating an immersive environment where everyone is learning, using the latest technology, developing and communicating new educational resources, and creating a community of mathematics enthusiasts.

## Ethiopia

The 2018 camp was a great success with feedback from repeat volunteers commenting on how smoothly the camp went. Georg Osang and Michal Rolinek from SAMI and five other international volunteers helped the local team run the camp for 58 students. There was a good gender split. The students took a day or so to warm up and then participated well. Particularly useful to the running of the camp were returning student volunteers who had participated the previous year and acted as translators to help with the language barrier.

## Ghana

Five international volunteers, and 16 local volunteers ran another great camp at AIMS for 26 boys and 24 girls. Amongst the local volunteers were returning students who were particularly appreciated. Almost all volunteers delivered a session at the camp. A large donation of around £900 was given by Dr. Olivier Menoukeu Pamen, the German Research Chair at AIMS, which meant that no financial input was needed from SAMI. A representative from African Science Academy came to give a presentation on how they run a bridging programme from local secondary schools to international universities.

## Kenya - Summer

50 students (20 girls, 30 boys) were engaged in exciting maths and statistics by 9 international and 9 local volunteers over the course of the week. There was a nice collaboration between the volunteers on several themes and some newer AMI team members stepped up well to leadership roles. The London Maths Society gave a small grant to Esmee te Winkel to help her support the camp.

## Kenya - December

### Background

AMI was approached earlier in the year to host an additional maths camp to celebrate Africa Science Week. The camp was organised in partnership with the Mawazo Institute, a Kenyan non-profit which aims to support the next generation of female thought leaders and scholars in Africa. As such, for the first time, the camp has been organised specifically for female students, with 40 young women selected from across the country and provided with a full bursary to attend the camp.

### Logistics and Funding

The camp was fully funded by the institute, with the total budget (\$5000) covering all costs including student and volunteer accommodation, travel expenses and resources.

## Planning Week

The local team consisted of 11 staff/interns (Zach Mbasu, Maxwell, Patrick N, Mike, Yvonne, Beryll, Lazarus, Patrick E, Maina, Wycliff, Ivan and two additional returning volunteers (Laetitia, Cabrine).

International volunteers Chris and Marta joined for the planning week.

The themes chosen were Programming, Robotics, Cryptography, Mathematical Thinking, Statistics, Maths Club. The majority of the local team had attended multiple camps before and hence were very prepared, and as pre-existing themes were to be used (with some modifications) the overall workload seemed very reasonable.

The camp week took place from 2nd to 8th December. Feedback during the week was very positive, with students saying their perceptions in maths had been changed and many now feeling confident about studying maths in the future.

## Maths Camp in London

SAMI's fourth Maths Camp in London was hosted in partnership with Harris Westminster Sixth Form from 22nd to 26th October 2018 for 28 students in Year 12 and Year 13 (13 girls and 15 boys).

The HWSF/SAMI maths camp was a week-long event that brought together students, teachers, lecturers and maths enthusiasts from all walks of life, in shared exploration and discovery of ideas which stretch far beyond the traditional school curriculum. It was also an opportunity to reach out and help those who otherwise might not get such experiences in life as all the proceeds of the camp went to SAMI - £3504.68.

Many people gave up their time to support the camp. Emily Fleming, James Handscombe, Gary McConnell, Jeff Goodman and Matthew Boswell were the key organisers but were supported with excellent sessions by Tony Gardiner, Simon Singh, Bruce Hobbs, Alex Paseau, Kevin Buzzard, Balazs Szendroi, Gianmarco Bet, Chris Clarke, Danny Parsons and Rudra Jena.

Asmodee games donated sets of Dobble to use at the camp and Gary McConnell and Jocelin Harris sponsored students. Students paid what they could afford for the camp, so it was an inclusive event at the same time as a fundraiser.

We had support from experienced camp organisers and volunteers from Africa. We were fortunate to have Francis Torgbor, founder of the Allotey (Ghana) Maths Camp, come to deliver a brilliant session on his research into climatic data. Other special visitors included Adowa

Appiah, former volunteer at the Allotey Maths Camp and Rose Mutiso from the Mawazo Institute in Kenya who was ready to sponsor an all-girls maths camp in partnership with AMI.

## BCME Conference

SAMI part-funded the attendance of Chris Clarke at the British Congress of Mathematics Education in Warwick ([www.bcme.org](http://www.bcme.org)) in April 2018 and the Lycee Francais Charles de Gaulle funded fellow director Emily Fleming. As it only happens every four years, it was great to be part of such an important event. It ran from Tuesday lunchtime until Friday lunchtime in the first week of the Easter holidays.

Emily and Chris gave a workshop entitled “Inspiring ideas for maths clubs” which was well attended and received. They gave the attendees some interesting puzzles to try, and then discussed the work SAMI does in Kenya and how it has led to Emily and Jeff Goodman setting up a successful maths club at the Lycee. They explained how students at the Lycee have collaborated online with students in Kenya via the Maths Club website ([www.lycee.samicharity.co.uk](http://www.lycee.samicharity.co.uk)) and invited other schools to join us in this. The “maths club pack” of resources was shared for people to use in their own schools.

During the rest of the week Emily and Chris attended many interesting sessions on all areas of mathematics teaching and learning.

Aside from the formal sessions there was a quiz, a conference dinner and a “maths jam”! All of which meant opportunities to meet interesting people and discuss the work that SAMI does. One great meeting was with inspiring mathemagician Andrew Jeffrey who subsequently donated the profits of his [card games book](#) to SAMI. Chris also recruited a volunteer for the Ghana maths camp, and contacts were made for future collaborations.

## Supporting AMI work

AMI has continued to flourish under the guidance of Zach Mbasu, whom SAMI has paid a stipend during the year. Zach has had an extremely busy year supporting local interns, running teacher training workshops, working on a research project with the University of Nottingham, working with [Tutor-web](#) and attending conferences as far away as Beijing.

Some key initiatives that SAMI has supported via AMI follow below.

### Africa Code Week

After the success of a week of computer programming sessions in 2017, the AMI team were one of 60 organisations (out of almost 300 applications) to receive a google grant to run the event again in October 2018.

They kept to the same model of running one programming day five times so that as many students as possible could benefit.

The aim of the activities during the week were to introduce teachers and kids from rural Kitale region to basic coding skills, develop their computational thinking and get them excited about opportunities available in computer science. We conducted programming workshops for 47 teachers, 14 students and 37 teacher trainees. We trained teachers so that they could help their students back in their schools. This was the second time that African Maths Initiative held these series of one day workshops for five days for teachers and students from rural remote areas and disadvantaged communities in Trans Nzoia county, Kenya.

Each day was packed with activities using 10 Meet Edison robots purchased by SAMI. Cape Town Science Centre were sponsors of the event and Manor House Agricultural Centre were the hosts.

### Kolibri

Zach Mbasu was helped by SAMI to make a successful grant application from [Learning Equality](#) for \$15,000 USD. With a commitment to reaching learners in connectivity-scarce environments, Learning Equality is aiming to bring its new open-source platform, [Kolibri](#), to learners who are otherwise unable to access high quality educational content.

Supported by funding from Google.org, Learning Equality gave the grant to purchase necessary hardware to implement Kolibri in formal schools, educational facilities, and non-formal learning settings to reach both school-aged and adult learners. The team in Kenya have sourced

hardware and are using Kolibri with three schools. SAMI has helped with the sourcing and budget for the project.

## Supporting Studies

Mike Mumbo has been involved with AMI and SAMI over the past 5 years, and is passionate about maths education. He has chosen to enrol in a distance learning programme from education and SAMI decided to actively support this with a donation of £400. SAMI has no doubt that he will make the most of this experience, and it will help with his work for SAMI and AMI. The funds have come from a generous donation from Stats4SD (see below).

## Maths Club Ghana

Following on from the success of the Allotey Maths Camp, Francis Torgbor has led a group of teachers and volunteers keen to reach out to students in their schools. SAMI has funded some transport costs for initial meetings of the group and for visits to schools. There have been some successful visits to schools with presentations on why maths is important followed by interactive games and puzzles. It has been a difficult process logistically though due to the unstable and unclear timetable structure of students in the new free senior high school education policy implementation. Several school visits have been planned and cancelled at the last minute, and the team are looking to work with teachers in schools directly.

## Fundraising

### IMU grant

Franca Hoffmann and Francis Torgbor successfully applied for a 4000EUR grant from the International Mathematical Union (IMU) in November 2018. SAMI is looking forward to supporting an event with the funds entitled “Cross Pollination Workshop”. The idea is that local facilitators from all of our camps across Africa get together to share ideas and make plans for the future.

### Stats4SD

Statistics for Sustainable Development (Stats4SD) is a not-for-profit, social enterprise established in May 2016. They promote better use of statistical methods for decision-making to benefit society and the environment. SAMI was very grateful for a £4000 donation from

Stats4SD this year and is looking forward to spending it expanding our high school work in Kenya, publicising this work and supporting a maths camp next year.

## St Peter's Fundraising dinner

As a first for SAMI, a fundraising dinner was arranged at St Peter's College, Oxford by director Balázs Szendrői. The evening consisted of drinks and a presentation by SAMI directors followed by a delicious dinner at high table. St Peter's College and SAMI directors paid for the evening and invited eight distinguished guests who were all very interested in the work that SAMI is doing and have made significant donations of money and time since the dinner.

St Peter's College also supported SAMI this year by supporting two of their students to volunteer at the maths camp in Kenya and to work with the AMI team for two weeks beforehand. This support was much appreciated and hoped to keep this partnership going.

## Marathon

Erin Bastian ran the hottest London Marathon ever on behalf of SAMI in April 2018. She did brilliantly fundraising beforehand with a dinner and a talk and a fundraising page, and was absolutely amazing on the day running in the high temperatures. She raised £1839.25 altogether (some of which came under last years donations).

## Other donations

SAMI has been fortunate to receive donations and raise money in many varied ways this year:

- Regular direct debits, one with matched funding
- Artur Donaldson completed the Thames Path Challenge
- Andrew Jeffrey donated the proceeds of a magic book
- SAMI members asked for donations in lieu of Christmas presents
- Donations in lieu of flowers and gifts at a funeral and a wedding
- Donation of a refund from a cancelled flight
- Raising money by selling Christmas decorations at the lycee.

# 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 trustees of SAMI stand 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. Trustees and members use a number of online systems to help run the charity.

Currently all 35 members are voting members.

## Related parties and co-operation with other organisation

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.

## Statement of financial activities

Statement of financial activities (incorporating Income and Expenditure account)  
For the period ended 28th February 2019

### Income

	Unrestricted funds (£)	Restricted funds (£)	Total 2019(£)
<b>Donations</b>			
Personal fundraising and donations	5,990	-	5,990
Benevity donation	294	-	294
Marathon	1,603	-	1,603
Business Sponsorship	380	-	380
IMU Grant		3,515	3,515
Stats4SD Grant		4,000	4,000
<b>Charitable activities</b>			
SAMI Maths Camp	3,505		3,505
<b>Other trading activities</b>			
Attracting donations in exchange for used corks	242	-	242
Using EasyFundraising online	121	-	121
Paypal Giving Fund	298	-	298
Amazon Smile	50	-	50
<b>Investment income</b>			
	-	-	-
<b>Total incoming resources</b>	<b>12,484</b>	<b>7,515</b>	<b>19,999</b>

Statement of financial activities (incorporating Income and Expenditure account) - continued  
For the period ended 28th February 2019.

## Expenditure

	Unrestricted funds (£)	Restricted funds (£)	Total 2019 (£)
<b>Cost of generating funds</b>			
London Bike place	270	-	270
Posting corks	7	-	7
SAMI Camp Expenses	71	-	71
<b>Charitable activities</b>			
Maths Camps in Africa	1,026	-	1,026
Supporting AMI work	8,601	-	8,601
African Data Initiative	-	14,047	14,047
Digital Communities Initiatives	-	250	250
Stats4sd		400	400
Maths Club Ghana	200		200
Governance costs -companies house registration	-	-	-
<b>Total expended resources</b>	<b>10,175</b>	<b>14,697</b>	<b>24,872</b>

<b>Net income/expenditure and net movement in funds</b>	2,309	-7,182	-4,873
Funds brought forward	2,264	18,438	20,702
<b>Funds carried forward</b>	<b>4,573</b>	<b>11,256</b>	<b>15,829</b>

## Balance Sheet as of 28th February 2019

	Total funds 2019 (£)
<b>Current assets:</b>	
Debtors	0
Cash at bank and in hand	15,829
<i>Total current assets</i>	15,829
Creditors: Amounts falling due within one year	0
<i>Net current assets or liabilities</i>	15,829
<b>Total net assets</b>	15,829
<b>Reserves</b>	
Unrestricted funds	4,573
Restricted funds	11,256
	15,829

For the period ended 28 February 2019 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 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 2015).

Approved and authorised for issue by the Directors on 31/10/2019 and signed on their behalf by:

  
Signed:  
Name: Emily Fleming (director)

  
Signed:  
Name: Jeff Goodman (director)

## Notes to the Accounts

For the period ended 28 February 2019

### 1. Accounting policies

#### *Basis of Accounting*

The financial statements have been prepared under the historical cost convention. There 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.

Notes to the accounts (continued)  
 For the period ended 28 February 2019

## 2. Breakdown of expenditure on Charitable Activities

<b>Expenditure (Unrestricted)</b>	Maths camps in Africa (£)	Supporting AMI work (£)	Maths Club Ghana (£)	Total (£)
<b>Costs directly allocated to Charitable activities</b>				
Stipends	-	8,199	-	8,199
Food, accommodation, transport and resources for students and local teachers	646	-	-	646
Sponsorship for students	380	-	-	380
Transport and resources for facilitators, students and local teachers to launch maths clubs in Ghana	-	-	200	200
<b>Support costs allocated to Charitable activities</b>				
Foreign transfer bank fees	-	402	-	402
<b>Total expended funds (unrestricted)</b>	<b>1,026</b>	<b>8,601</b>	<b>200</b>	<b>9,827</b>

Notes to the accounts (continued)  
For the period ended 28 February 2019

3. Breakdown of expenditure on Charitable Activities (continued)

<b>Expenditure (Restricted)</b>	<b>African Data Initiative (£)</b>	<b>Digital Communities Initiative (£)</b>	<b>Stats4sd (£)</b>	<b>Total (£)</b>
<b>Costs directly allocated to Charitable activities</b>				
Stipends	13,930	-	-	13,930
Sponsorship for studies	-	-	400	400
Facilitation/Dissemination including transport	-	250	-	250
Video creation	100	-	-	100
<b>Support costs allocated to Charitable activities</b>				
Bank charges	17	-	-	17
<b>Total expended funds (restricted)</b>	<b>14,047</b>	<b>250</b>	<b>400</b>	<b>14,697</b>

Notes to the accounts (continued)  
For the period ended 28 February 2019

### 3. Funds

	At 28 Feb 2018	Income	Expenditure	At 28 Feb 2019
<b>Unrestricted funds</b>				
General funds	<u>2,264</u>	<u>12,484</u>	<u>(10,175)</u>	<u>4,573</u>
Total unrestricted	<u>2,264</u>	<u>12,484</u>	<u>(10,175)</u>	<u>4,573</u>
<b>Restricted funds</b>				
African Data Initiative	<u>14,047</u>	<u>0</u>	<u>(14,047)</u>	<u>0</u>
Digital Communities Initiative	<u>4,391</u>	<u>0</u>	<u>(250)</u>	<u>4,141</u>
Stats4sd	<u>0</u>	<u>4,000</u>	<u>(400)</u>	<u>3,600</u>
Cross Pollination	<u>0</u>	<u>3,515</u>	<u>0</u>	<u>3,515</u>
Total restricted	<u>18,438</u>	<u>7,515</u>	<u>(14,697)</u>	<u>11,256</u>
Total funds	<u>£20,702</u>	<u>£19,999</u>	<u>£ (24,872)</u>	<u>£15,829</u>

#### Details of restricted funds

##### *African Data Initiative*

Funds received to support the ADI project to address the problem of statistical literacy in Africa and beyond.

##### *Digital Communities Initiative*

Funds received to help to enable both children and adults in rural Kenya to work towards a better future, through integration of digital technology into key life activities.

*Stats4sd*

Funds received to support projects in Africa.

*Cross Pollination*

Grant received to enable facilitators at different maths camps in Africa to get together to share best practice.

4. Trustee remuneration

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

# Appendix 1

## Explanation of key words 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 is 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. (possibly worth adding example where such thought process comes in...). 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:

	<b>Adaptive</b>	Disruptive
<b>Formal</b>	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.