![sami logo](Supporting African Maths Initiatives)

Supporting African Maths Initiatives

Supporting African Maths Initiatives
(A company limited by guarantee)

Report and Financial Statements
for the year ended 28th February 2018

Charity number 1161994
Company number 9458921

Chair's report

As our third year as an incorporated charity comes to a close, we once again take this opportunity to thank our growing team of volunteers who have helped us continue to reach our aim of improving access to quality mathematics education throughout Africa.

This past year our volunteers have helped contribute to successful running of Maths Camps in Ghana, Kenya, Ethiopia and Tanzania. A particular thank you to those volunteers who have returned for a second summer and to those who have helped spread the word in recruiting new volunteers.

We are once again proud to work closely with Zach Mbasu who leads many of the projects detailed in this report with passion and drive. The running of the Maths Camp at the Lewa Wildlife Conservancy and the Africa Code Week are two impressive highlights.

For those who have contributed to our financial support, we remain extremely grateful. Thanks are owed to Marc Jeannin, Eduardo Epperlein and Ged Dover for cycling Scotland for SAMI. The wonderful team at Asmodee have supported the Maths Camps through their generous donation of Dobble.

Finally, although we were sad to accept the resignation of Amy Fletcher as director, we are delighted to add two new directors Chris Clarke (executive) and Balazs Szendroi (non-executive) and thank Jeff Goodman and Franca Hoffmann (who continues on as a non-executive director) for their continued hard work in driving SAMI forward.

More information can be found at www.samicharity.co.uk.

Emily Fleming

Chair

Supporting African Maths Initiatives - Report of the Management Committee for the year ended 28th February 2018

The Management Committee presents their report and the financial statements for the period ended 28th February 2018 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   Chair
Mr Jeff Goodman
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 Iordan Ganev
Miss Kelly Pickerill
Miss Lily Clements
Mr Michael Rolinek
Mr Marc Jeannin
Mr Filippo Mancini
Miss Monica Mancini
Mr Georg Osang
Miss Rachel Knott
Ms Marta Maggioni
Mr Danilo Lewanski
Ms Giovanna de Giusti

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:
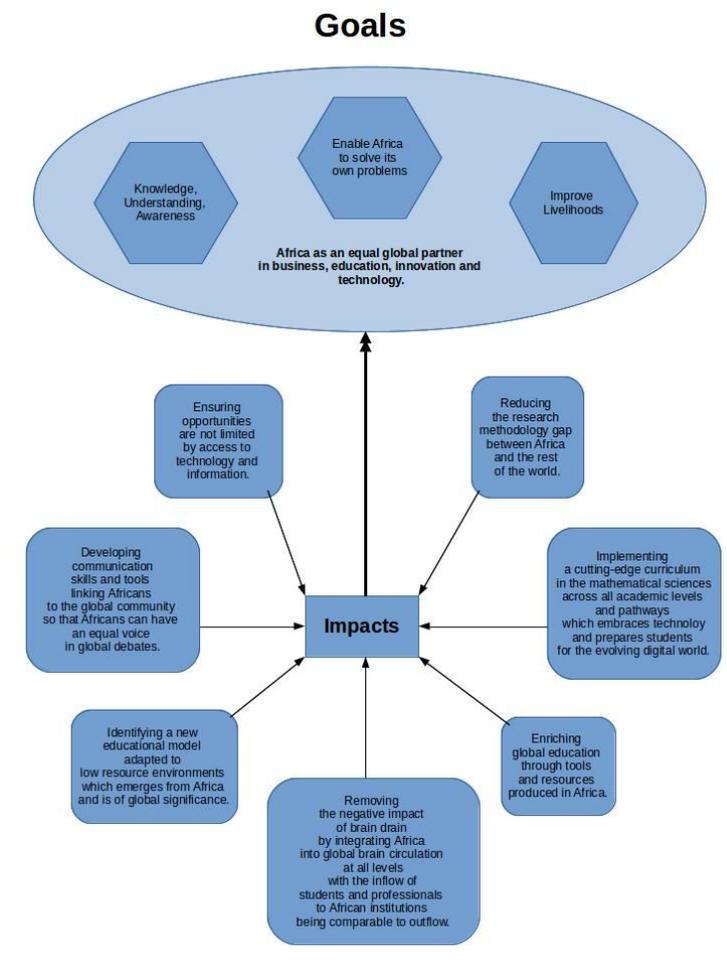
Ensuring our activities meet our aims and objectives

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.

Lewa Maths Camp

The second Lewa maths camp was hosted at Lewa Wildlife Conservancy in Central Kenya from 18th to 22nd April, 2017. 52 high school students coming from diverse communities with the majority from North Eastern and Eastern Provinces participated in the camp. 6 Lewa staff and 4 AMI volunteers facilitated in the camp. Themes at the camp included statistics, geometry, programming, maths clubs, career talks, card games and puzzles. We are collaborating and supporting Lewa Wildlife conservancy to establish maths clubs in schools around the conservancy.

AMI strengthened their partnership with Lewa Wildlife Conservancy by helping to run another maths camp in November 2017. The sessions were run jointly by volunteers from AMI and the Lewa Wildlife Conservancy Education Program team. A total of 51 high school students (form two) attended the camp. They comprised of 25 boys and 26 girls from 14 different secondary schools. They came from diverse communities surrounding the conservancy, a majority from North Eastern and Eastern Provinces of Kenya. In addition to the mathematical sessions, physical activities and card games, other sessions included in the camp this time were career talks, guiding/counselling meetings and motivational talks facilitated by the Lewa Staff, external speakers and AMI team members.

Tanzania Maths Camp

The 2017 camp was hosted at African Institute of Mathematical Sciences, Bagamoyo Tanzania from 3rd to 8th July, 2017. 60 students with a good representation of both boys and girls from various regions within Tanzania, 10 local volunteers including AIMS students and 2 international volunteers participated in the camp. Themes at the camp included cryptography, mathematical thinking, statistics, programming, maths clubs, and inspirational career talks. As a way to provide continued support to the participants and other students, AMI in collaboration with AIMS and Projekt Inspire is working on establishing Maths clubs and STEM clubs in the participants' respective schools.

Ethiopia Maths Camp

The fifth camp held at Bahir Dar University was a great success, with 84 students from grade 9 -11, 41 girls and 43 boys. 24 local volunteers, 5 international volunteers and 5 returning

students ran the camp. This was the first maths camp where students came from rural areas around Bahir Dar instead of from within Bahir Dar. This meant that there were some language difficulties, but having students from the previous camp return as helpers eased this issue. These volunteers also made a big difference in the card game sessions. The themes for the camp were Statistics, Geometry, Game Theory/Modelling, Combinatorics, Programming and Physical activities, many of which involved computers. Some students were introduced to computers for the first time.

Ghana Maths Camp

The fourth Ghanaian Maths Camp was run by 12 local volunteers and 8 international volunteers. 39 students (22 girls and 17 boys) from over 20 schools, and 3 teachers attended the camp. The themes for the camp were Mathematical Research, Geometry, Modelling, Combinatorics and Programming. Students also enjoyed a treasure hunt, physical games and card games in the evenings.

Supporting AMI work

SAMI has paid Zach Mbasu, CEO of AMI, a stipend to run various initiatives throughout the year. Local interns have been under Zach's supervision and have also contributed to some of the projects below. Some of these interns have been offered wonderful opportunities and proceeded to careers in STEM like Steve Kogo who is now the Climate Data Analyst at PULA advisors, Steven Ndung'u has just proceeded to doing a cooperative masters degree at African Institute of Mathematical Sciences and John Lunao who has just taken up a data manager position.

Africa Code Week

The AMI team hosted a very successful series of computer programming days during Africa Code Week in October 2017. The aim of the activities during the week was to introduce kids from rural Kitale region to basic coding skills and get them excited about opportunities available in computer science. To be able to achieve this aim it was important that participants for these workshops found enjoyment in learning programming, code and experience the applicability with robots. This was the first time African Maths Initiative held this series of one day workshops for five days with 203 kids (51% girls and 49% boys) 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.

AIMS Teacher Workshop

In order to achieve their goal of reaching out to Maths teachers, AMI supported AIMS Tanzania to run a one day teacher workshop for 24 mathematics teachers from 12 schools around Tanzania. The workshop was based on the AIMSSEC Mathematical Thinking courses which support teachers to run workshops for other teachers.

AMI also ran a one day workshop with 100 trainee teachers at Morogoro Teachers Training College. The workshop sessions reflected on teaching methods and employing them to enable students to understand the mathematics that they are learning, to make connections between mathematical concepts and to develop skills of problem solving, working systematically, visualising, generalising, thinking creatively, conjecturing and proving.

School Visits

AMI has conducted regular school visits over the last year, at least fortnightly to two schools in Tanzania (Kangani school and Shaaban Robert secondary school in Tanzania) and five schools in Kenya (Tande, MFA, STA, St. Antony, Wekhonye and Birunda). During the school visit sessions, AMI actively engaged both students and teachers in mathematics. Just like the teacher workshops they reflected on learning methods and how to enable students to understand the mathematics that they are learning, to make connections between mathematical concepts and to develop skills of problem solving, working systematically, visualising, generalising, thinking creatively, conjecturing and proving.

Supporting Agriculture Research work (Cornell University)

AMI is supporting an applied field research project in Western Kenya that is being led by Dr. Beth Medvecky from Cornell University. AMI has supported two interns who work with small farming communities. Under the guidance of Beth, the interns are guided through a process of designing, implementing, collecting and analyzing data from smallholder farming communities. Over the past 8 months, 3 experiments on evaluation of basal fertilization strategies and evaluation of top dress fertilization to improve maize productivity have been conducted with farmers in Mumias, Kitale. Other AMI interns are involved in preparing, organizing and analyzing the data from the experiments using R-Instat.

African Data Initiative (ADI)

The ADI team launched the beta version of R-Instat and the ADI project in a special topic session at the World Statistics Congress end of July 2017 in Marrakech, Morrocco, kick starting the next phase of ADI. R-Instat is already being used to improve teaching and research in various African countries. After the conference, a number of professors in numerous universities across Africa have expressed interest in using the software in their introductory statistics courses. Lecturers at Maseno University are already using R-Instat this semester to teach an innovative statistics course to their undergraduate students.

In March 2017 the ADI team held a workshop for AIMS Masters students titled *Data Driven Approach to Measuring Corruption Risks*. Students learnt about the ways in which data are being used to measure and monitor corruption risks in public procurement and they got to use R-Instat's new facilities to analyse real procurement data from the World Bank.

Our partner Statistics for Sustainable Development (SSD) is using R-Instat in some of their projects, including to support agricultural researchers in West Africa who need to manipulate and analyse data from their surveys.

Workshop at AIMS Tanzania

AMI continues to work with our partners in AIMS Tanzania, and in March we held a workshop for their Masters students titled *Data Driven Approach to Measuring Corruption Risks*. Students learnt about the ways in which data are being used to measure and monitor corruption risks in public procurement and they got to use R-Instat's new facilities to analyse real procurement data from the World Bank.

R-Instat used in Workshops

Danny Parsons and Roger Stern attended a one week workshop in South Africa on using satellite data for climate services in Africa. It was run by the EUMETSAT organisation based in Germany, but they were invited to include R-Instat as part of the course, and it seemed to be very useful for the participants, almost everyone used R-Instat for their mini project. David Stern has been running workshops on data analysis in Niger, Burkina Faso and Mali as part of a project with the McKnight foundation for agriculture researchers, with R-Instat being the main software. The response to R-Instat has been very positive, it is now a product which is proven to be work in the field and is already being applied.

Digital Communities Initiative

Following on from SAMIs original £8000 grant from the Economist, in a new fundraising campaign on Global Giving SAMI raised nearly £4000 to be able to continue our project which uses tablets to support rural communities through schools and farmers.

Some highlights from the past year:

Primary Schools - We have been able to continually work with local primary schools throughout the year and successfully managed to conduct a full randomised control trial to evaluate impact. This pilot study was called "Unlocking talent through technology in Kenya; cross-cultural study. Unlocking Talent is a multi-partner international initiative that uses interactive child-centred apps to raise educational standards in maths and literacy for marginalized children worldwide. Running this pilot study was a huge undertaking, as it involved gaining ethical approval from partner universities in Kenya and UK, upskilling the local team to conduct pre and post tests using the EGMA and EGRA international standards and identifying an intervention timeline that wouldn't be disrupted by holidays or elections. We are at the final stage of analysing the data with Dr Pitchford from Nottingham University and look forward to publishing the results very soon.

Agriculture - The local team has recently moved its operations to the nearby Manor House Agricultural Centre, and taken the opportunity to expand their ideas for integrating technology into support for farmers. They have been part of numerous training programmes and have strong plans to keep building on these in the future. Food security is still a major issue, and over the past 2 years there were periods of both critical drought and intense flooding; new technologies and innovations are more important than ever to help farmers manage such unpredictable and difficult times.

Women in Enterprise - This has been a huge learning experience for the team, with much time spent travelling around the country to meet inspiring women running their own businesses. The team has been able to use videos to help support the learning of new skills such as beadwork and bag-making, and is also proud to share the success of one of it' own interns, Cabrine, who was invited to the Young African Leaders Initiative to learn more about human-centred design thinking, social inclusion and design challenges.

Fundraising

Marc Jeannin, Eduardo Epperlein and Ged Dover cycled the length (440 miles) of Scotland in four days, sleeping in tents with the midges. This incredible effort raised £2771 for SAMI.

This year we were fortunate to sign up our first direct debit sponsors, which brings in a small amount of much needed regular income.

Asmodee kindly donated 10 sets of Dobble for each of the three African maths camps. Other kind sponsors and supporters of the maths camps include Red Volta, AIMS Ghana, AIMS Tanzania and Bahir Dar University.

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. The OKR (Objectives and Key Results) system is used to set objectives three times a year, and then follow progress on these objectives.

Currently all 29 members are voting members.

This year we have made a distinction between different type of directors of the charity: executive and non-executive. There is no legal distinction made between the two, but the difference is that the non-executive directors are not generally involved in the day-to-day running of the business, but lend their expertise and experience to helping shape the charity and help make some of the big financial decisions. SAMI is fortunate in having Franca Hoffmann and Balazs Szendroi who are based at Caltech and Oxford University as their current non-executive directors. They are able not just to advise and help the charity grow, but are also seeking ways to involve their institutions.

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 2018

Income

	Unrestricted funds (£)	Restricted funds (£)	Total 2018(£)
Donations			
Personal fundraising and donations	7,458	-	7,458
Benevity donation	823	-	823
iMac sold on ebay	-	488	488
Crowd funding campaign to extend DCI project	-	3,891	3,891
Charitable activities			
	-	-	-
Other trading activities			
Attracting donations in exchange for used corks	126	-	126
Using EasyFundraising online	143	-	143
Contract from Oxford University to develop ADI software	-	1,100	1,100
Contract from Sussex University to develop ADI software	-	10,000	10,000
Investment income			
	-	-	-
Total incoming resources	**8,550**	**15,479**	**24,029**

Statement of financial activities (incorporating Income and Expenditure account) - continued
For the period ended 28th February 2018

Expenditure

	Unrestricted funds (£)	Restricted funds(£)	Total 2018(£)
Cost of generating funds			
London Marathon place	396	-	396
Posting corks	6	-	6
Charitable activities			
Maths Camps in Africa	886	-	886
Supporting AMI work	8,180	-	8,180
African Data Initiative	-	12,816	12,816
Digital Communities Initiatives	-	3,664	3,664
BCME conference	200	-	200
Governance costs -companies house registration	13	-	13
Total expended resources	**9,681**	**16,480**	**26,161**

Net income/expenditure and net movement in funds	-1,131	-1,001	-2,132
Funds brought forward	**3,395**	**19,439**	**22,834**
Funds carried forward	**2,264**	**18,438**	**20,702**

Balance Sheet as of 28th February 2018

	Total funds 2018 (£)
Current assets:	
Debtors	0
Cash at bank and in hand	20,702
Total current assets	20,702
Creditors: Amounts falling due within one year	0
Net current assets or liabilities	20,702
Total net assets	20,702
Reserves	
Unrestricted funds	2,264
Restricted funds	18,438
	20,702

For the period ended 28 February 2018 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 28 November 2018 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 2018

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 2018

2.Breakdown of expenditure on Charitable Activities

Expenditure (Unrestricted)	Maths camps in Africa (£)	Supporting AMI work (£)	BCME Conference (£)
Costs directly allocated to Charitable activities			
Stipends	-	7,311	-
Flights	399	-	-
Technology	-	433	-
Food, accommodation and resources for students and local teachers	487	-	-
Conference fee	-	-	200
Support costs allocated to Charitable activities			
Foreign transfer bank fees	-	436	-
Total expended funds (unrestricted)	**886**	**8,180**	**200**

Notes to the accounts (continued)
For the period ended 28 February 2018

3. Breakdown of expenditure on Charitable Activities (continued)

Expenditure (Restricted)	African Data Initiative (£)	Digital Communities Initiative (£)	Total (£)
Costs directly allocated to Charitable activities			
Stipends	3,875	1,525	5,400
Flights	4,577	190	4,767
Technology	817	1,341	2,158
Facilitation/Dissemination including transport and accommodation	3,513	417	3,930
Support costs allocated to Charitable activities			
Ethical approval		191	191
Bank charges	34		34
Total expended funds (restricted)	**12,816**	**3,664**	**16,480**

Notes to the accounts (continued)
For the period ended 28 February 2018

3. Funds

	At 28 Feb 2017	Income	Expenditure	At 28 Feb 2018
Unrestricted funds				
General funds	3.395	8,550	(9,681)	2,264
	3,395	8,550	(9,681)	2,264
Restricted funds				
African Data Initiative	15,763	11,100	(12,816)	14,047
Digital Communities Initiative	3,676	4,379	(3,664)	4,391
	19,439	15,479	(16,480)	18,438
Funds	£22,834	£24,029	£ (26,161)	£20,702

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.

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 fr 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:

	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.