



Adventures with Algebra and Geometry in East Africa

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Outline

1. Mathematics in Africa: challenges and opportunities
2. Activities in Africa to develop algebra and geometry research
3. Outreach activities



1.1 Mathematics in Africa: lofty beginnings

- Blombos Cave, South Africa: symbolic drawing from 70,000-100,000 years ago
- Ishango Bone, Congo: 20,000 years old.
Tally of objects? Diary? Basic arithmetic calculations?
- Nabtha Playa, Sudan: early stone circle from cca. 5000BCE

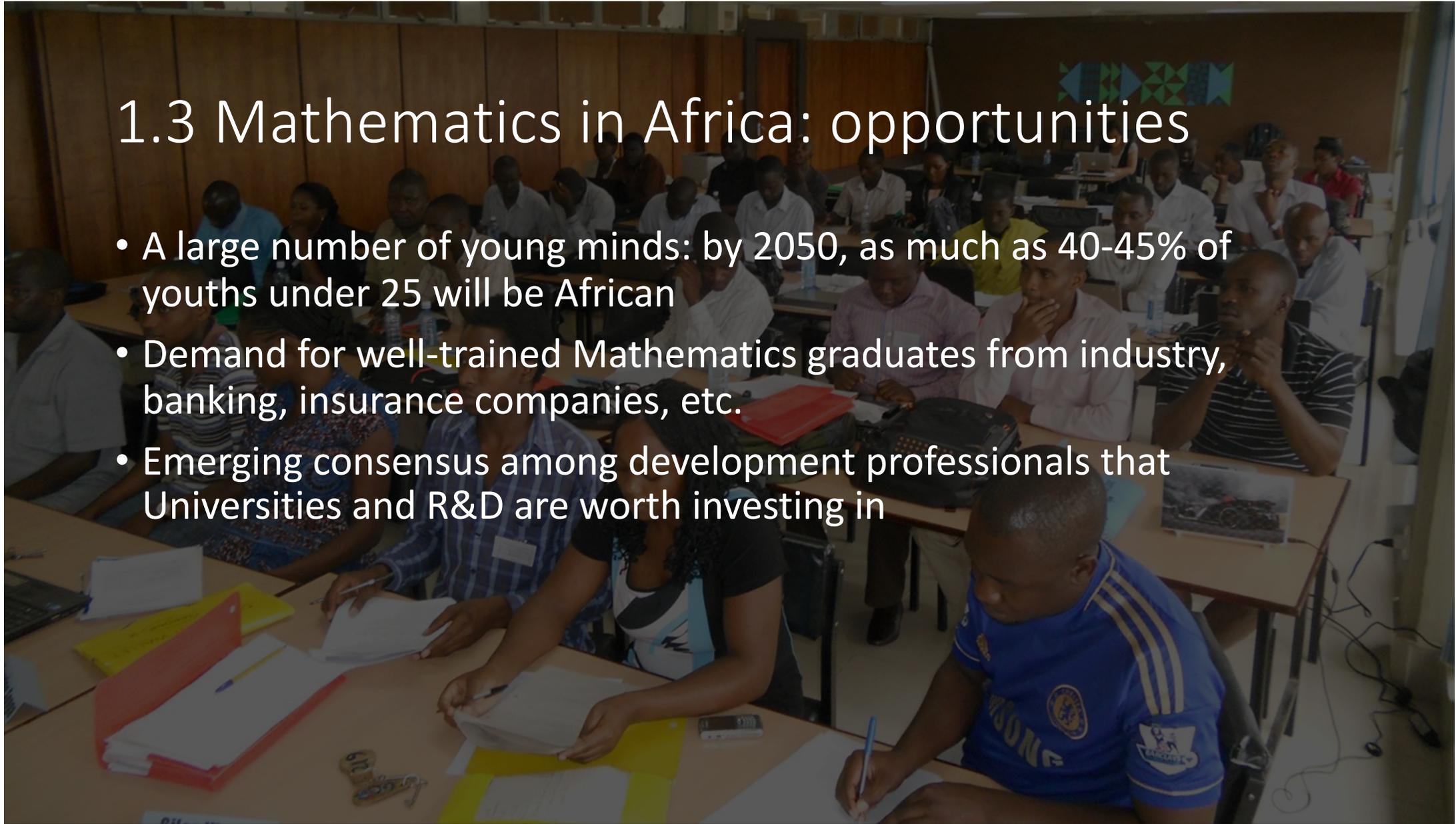


1.2 Mathematics in Africa: challenges

- At many Universities, there is no critical mass of active researchers
- For young graduates, difficulty of funding PhD studies abroad; local PhD programmes may be weak
- Recent PhD's are given large teaching loads and immediate responsibilities (Head of Dept, etc)
- Mathematical level of incoming undergraduates moderate
- Lack of funds to initiate international collaborations – especially "South-South" collaborations

1.3 Mathematics in Africa: opportunities

- A large number of young minds: by 2050, as much as 40-45% of youths under 25 will be African
- Demand for well-trained Mathematics graduates from industry, banking, insurance companies, etc.
- Emerging consensus among development professionals that Universities and R&D are worth investing in





2.1 The MARM scheme of the LMS

- MARM: Mentoring African Research in Mathematics, by the London Mathematical Society
- Relatively small grants (£10k) to individuals in the UK and elsewhere
- My first link to Africa: Department of Mathematics, University of Maseno

2.2 ICTP-EAUMP summer schools

- Summer school series on pure mathematics, organized together with
 - EAUMP: East African Universities Mathematics Programme
 - Members: Univ. Nairobi, Dar es Salaam, Makerere, Univ. of Rwanda and Zambia
 - ISP: International Science Programme of Uppsala University and Sida, Sweden
 - ICTP: International Centre for Theoretical Physics, Trieste, Italy
 - CIMPA / African Mathematical Union *Ecole Mathematique Africaine* programme
- Usually a 3-week school with 25-40 student participants and 4-6 lecturers



2.2 ICTP-EAUMP summer schools

- Since 2013:
 - 2013 School on Algebraic Geometry, Mombasa, Kenya
 - 2014 School on Representation Theory, Arusha, Tanzania
 - 2015 School on Experimental Mathematics, Makerere University, Uganda
 - 2016 School on Number Theory, University of Rwanda



- 2017 School on Modern Functional Analysis, University of Nairobi, Kenya
- 2018 School on Homological Methods in Algebra and Geometry, Dar es Salaam, TZ
- 2019 School on Algebraic Topology and its Applications, Makerere University, UG
- 2021 School Topics in Concrete Mathematics (remote school)
- 2022 School on Algorithms and Programming, Kenya

2.3 Nairobi workshops in algebraic geometry

- Organized together with Jared Ongaro, University of Nairobi, 2014-2021
- Topics included the study of graded rings, algebraic curves, computer algebra, differential geometry, etc.
- Main role: provide ideas for Masters projects
- Successful! 11 students graduated with Masters theses in algebraic geometry and related areas since 2014.
- 7 of these obtained international PhD positions in China, Germany, UK, Sweden



2.4 Abram Gannibal Project

- This was supposed to be an ambitious series of collaborative workshops in Uganda and Nigeria in spring 2020, followed by visits to the UK
- Workshops cancelled because of Covid-19, also no bilateral visits possible
- Remote workshops on computer algebra packages Macaulay2, Sage, Polymake, also systems biology
- Bilateral visits to the UK in early 2022, workshop at Chicheley Hall in March 2022



2.5 Emerging research groups in East Africa

- EAUMP-supported research groups since 2018
- Eastern Africa Algebra Research Group: lead by David Ssevviiri (Makerere University), members from Kenya, Ethiopia, Sudan, Kenya, Mozambique...
- Combinatorial Research Studio, led by Samuel Fufa (Addis), members from Ethiopia, Uganda, Madagascar...
- Others – see

<https://www.isp.uu.se/what-we-do/mathematics/networks/>



3.1 SAMI Math Camps

- SAMI: Supporting African Math Initiatives, charity based in the UK
- AMI: African Maths Initiatives NGOs registered in Kenya, Ghana
- Main activity: math camps aimed at 13-17 year olds - since 2013
- Currently organized in Kenya, Ethiopia, Uganda, Ghana, Togo, Rwanda...



3.2 SAMI Card Deck

- “Virtual Math Camp” card deck: deck of cards with mathematical problems
- Developed by SAMI during the pandemic
- Tell me if you would like some!

