



**AIMSSEC**

**AIMS**

**African Institute for  
Mathematical Sciences  
SCHOOLS ENRICHMENT CENTRE**

# **Education systems in South Africa, Ghana, Tanzania and Rwanda**

**Toni Beardon**

**University of Cambridge and AIMS**

Founder NRICH and AIMSSEC

<http://nrich.maths.org>

<http://aimssec.ac.za>

<http://aiminghigh.aimssec.ac.za>

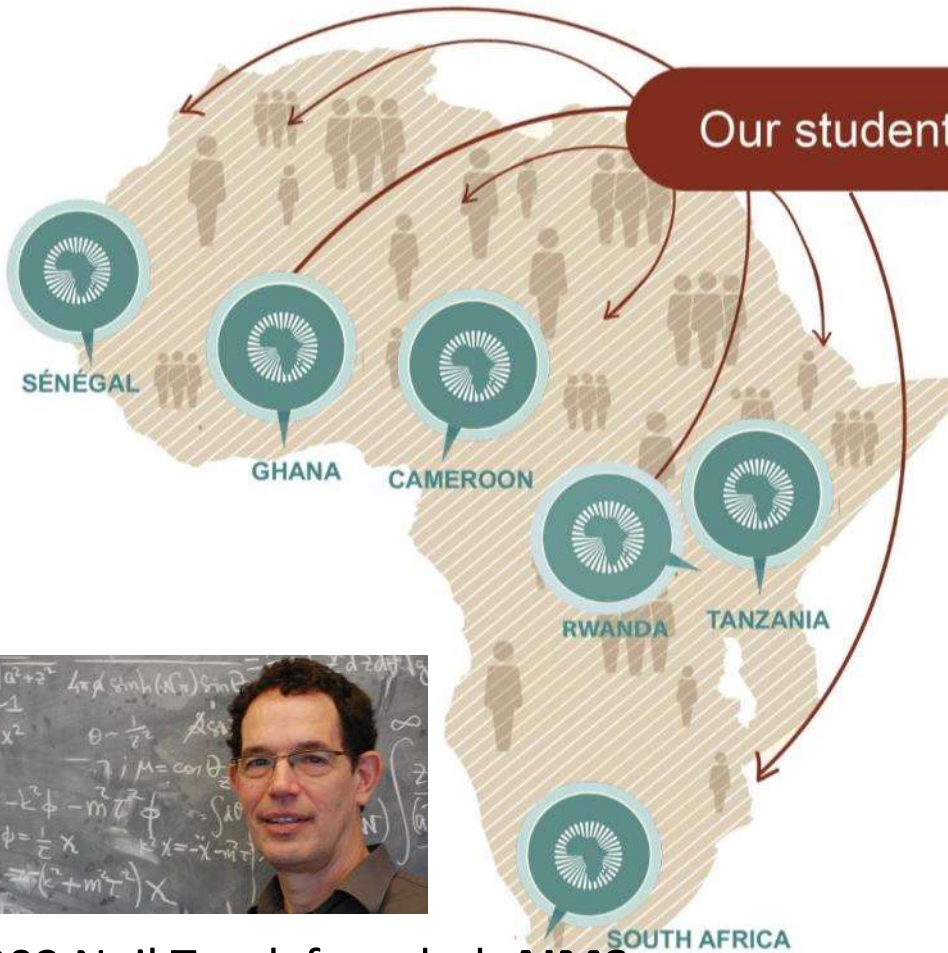
[toni@aimssec.ac.za](mailto:toni@aimssec.ac.za)



# AIMS

African Institute for  
Mathematical Sciences  
**NEXT EINSTEIN INITIATIVE**

Our students come from **42 countries**



## 2016

6 centres of excellence



## 2023

15 centres of excellence planned

In 2003 Neil Turok founded **AIMS**  
and Toni Beardon founded **AIMSSEC**  
**AIMSSEC** is based in South Africa

**“Education is the most powerful weapon you can use to change the world.”**      **Nelson Mandela**





<http://www.ctph.org/>





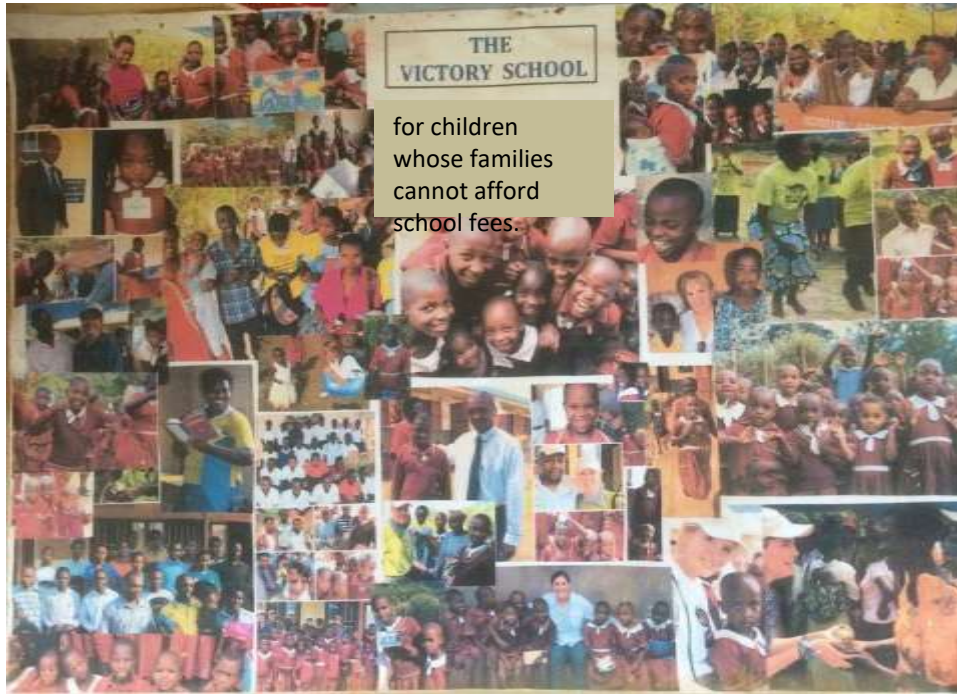








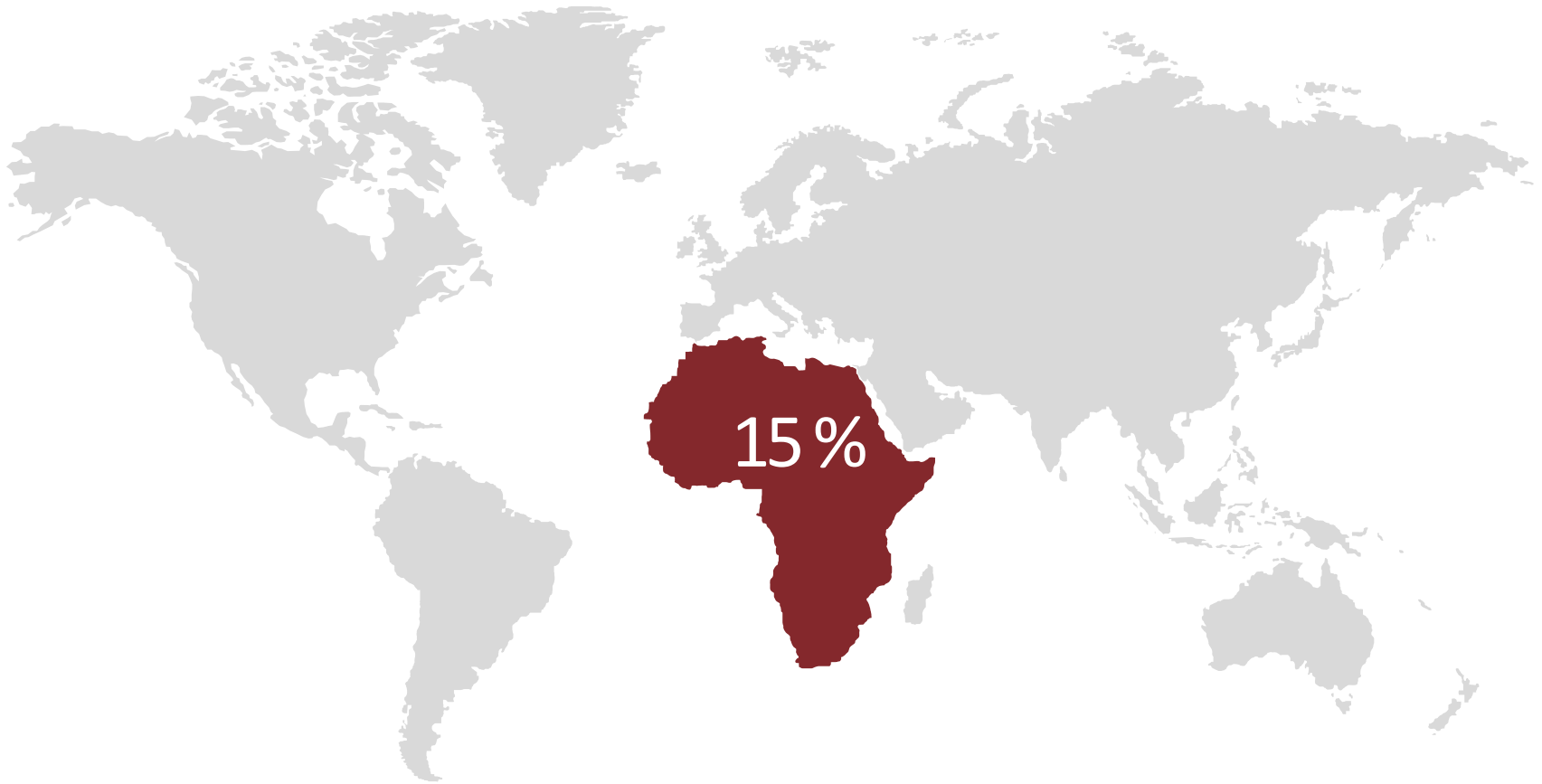
# VICTORY SCHOOL, BUHOMA VILLAGE, UGANDA



Science murals



# THE CONTEXT- WORLD POPULATION



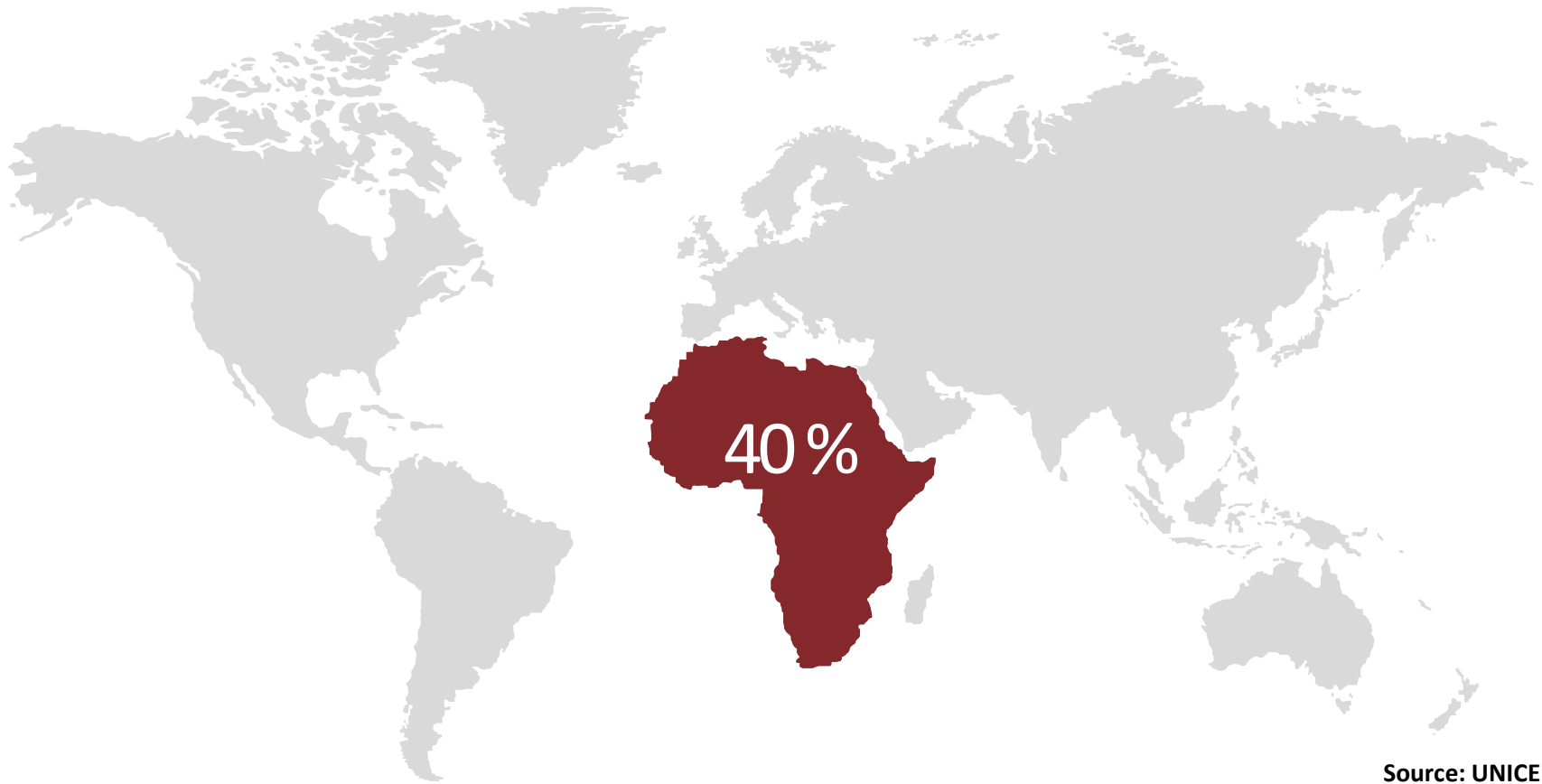
Today, 1 in 7 people in the world are African



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# THE CONTEXT- THE AFRICAN YOUTH



Source: UNICEF

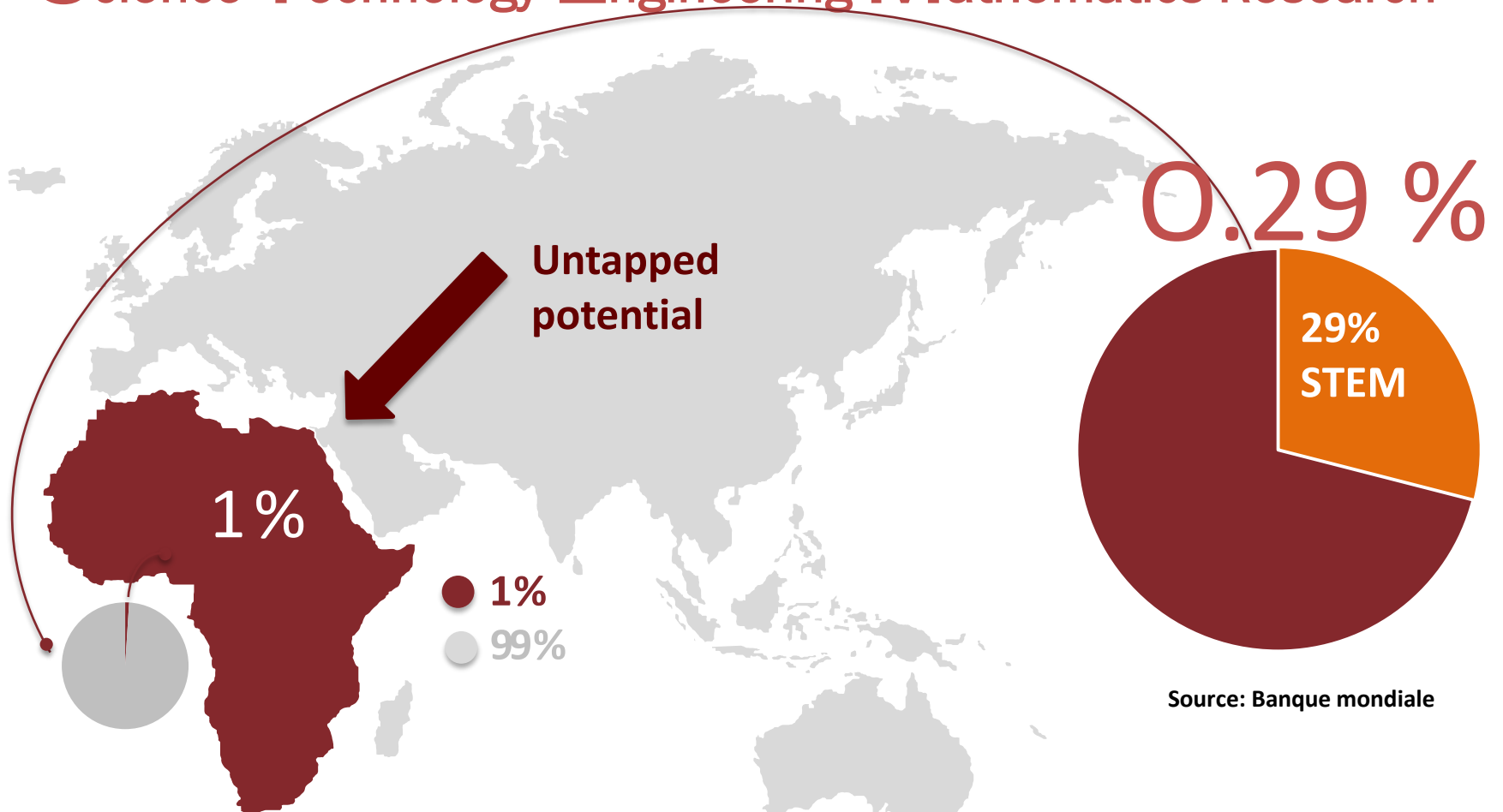
40% of the world's youth will be in Africa by 2050



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# Science Technology Engineering Mathematics Research



Africa research still accounts for less than 1% of world research output and for this 1%, less than 29% is in the STEM fields.



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**African Institute for Mathematical Sciences**  
**Schools Enrichment Centre**  
**AIMSSEC**  
**EMPOWERING TEACHERS**



Education must change to equip young people to meet the challenges of the 21<sup>st</sup> century.

## Report from United Nations Millennium Development Goals Summit in New York September 2010

- In Uganda 43% of the country's children did not receive primary education in 2008 and 78% did not receive secondary education.
- The only country in sub-Saharan Africa where more than half of all children attend secondary school is Cape Verde, the small island nation of about 430,000 people.”  
(<http://allafrica.com/stories/201009220930.html> )
- South Africa is ranked 138<sup>th</sup> out of 138 countries Mathematics and Science Education ([www.weforum.org](http://www.weforum.org) 2016 World Economic Forum Global Competitiveness Report page 325)

## Report from United Nations Millennium Development Goals Summit in New York September 2010

- Out of the ten worst places in the world to be a school child, seven are in Africa: Somalia, Eritrea, Comoros, Ethiopia, Chad, Burkina Faso, Central African Republic, Mozambique, Zimbabwe and Liberia.
- In East Africa, Uganda is the country with the worst education gaps, followed by Burundi, Tanzania, Rwanda and Kenya.





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## **Mission:**

Our mission is to enable Africa's brightest students to flourish as independent thinkers, problem solvers and innovators capable of propelling Africa's future scientific, educational and economic self-sufficiency.

**So we need a teaching style that will make this happen.**



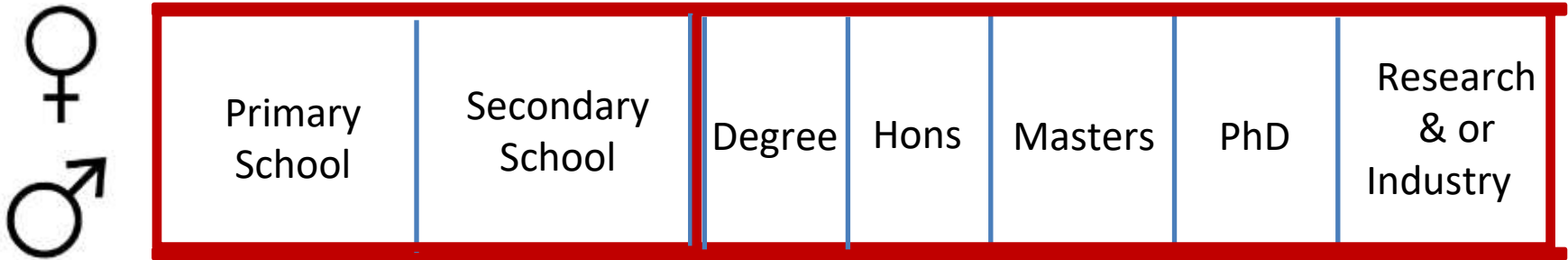
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2 programmes

AIMSSEC trains teachers

AIMS teaches graduate courses



Learners



Not enough



## Build the pipeline



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## School and township context in South Africa



South Africa has the greatest income inequality of any country in the world and this has increased in the last decade.

(World Economic Forum 2017/8)



# SOUTH AFRICA



**Teachers on Mathematical Thinking Course  
10 days residential + 3 months distance learning**



In 2012 AIMSSEC was awarded The UNESCO-Hamdan prize for Outstanding Practice and Performance in Enhancing the Effectiveness of Teachers in developing countries.

# TANZANIA



Teacher Training College Mgorogoro



Kingani School, Bagamoyo



Shabaan Robert School, Dar Es Salaam



Marian  
University  
Bagamoyo

# RWANDA



Toni talk at University of Kigali



Rwanda is the land of 1000 hills and even the steepest slopes are cultivated. Goats are tethered at regular intervals along the grass verges of busy roads. Every piece of land seems to be used.



AIMS Masters students AIMS Rwanda 2017/8

# GHANA

AIMS Ghana - Biriwa



Graduation



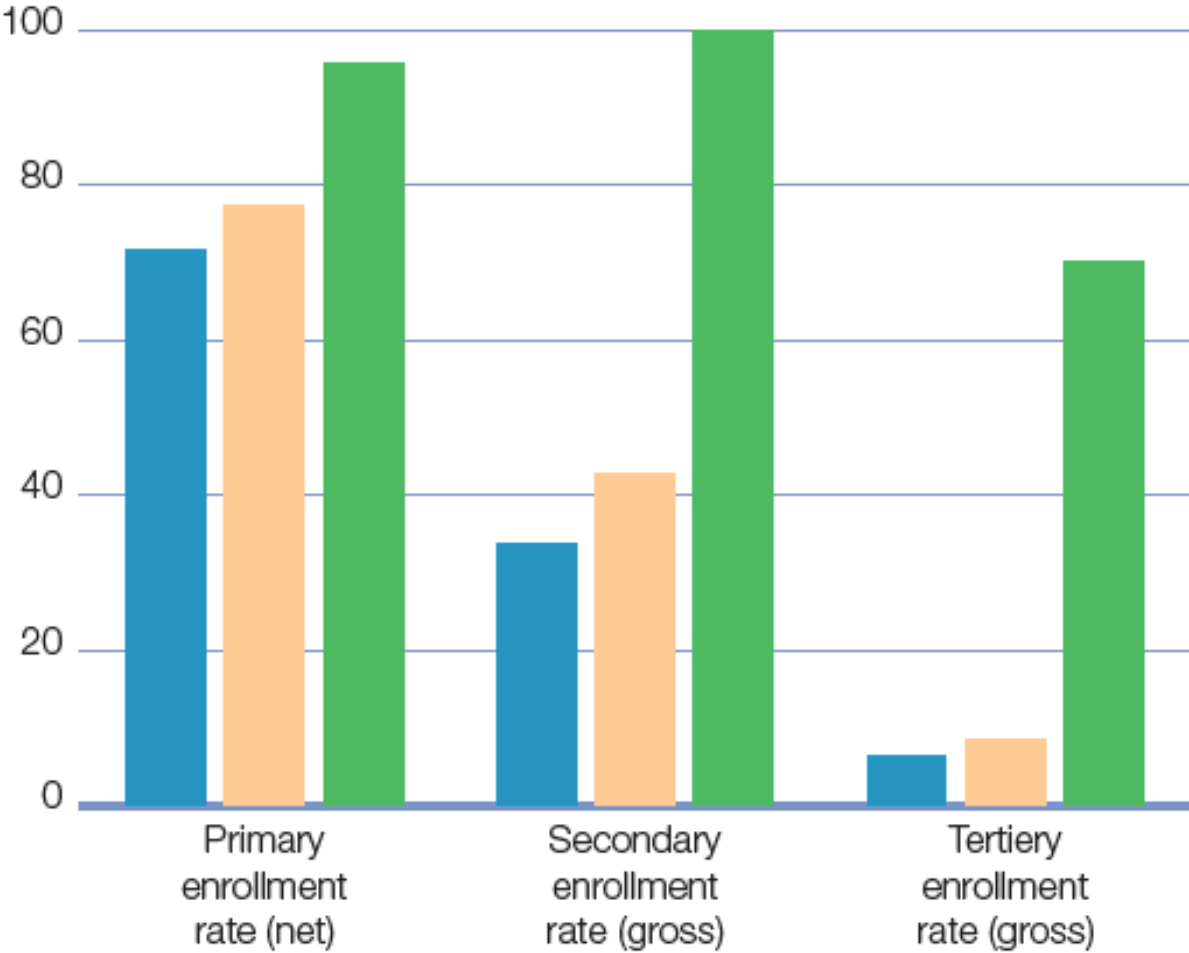
Biriwa Beach





# Education QUANTITY comparisons – Enrollment

Performance score ratio



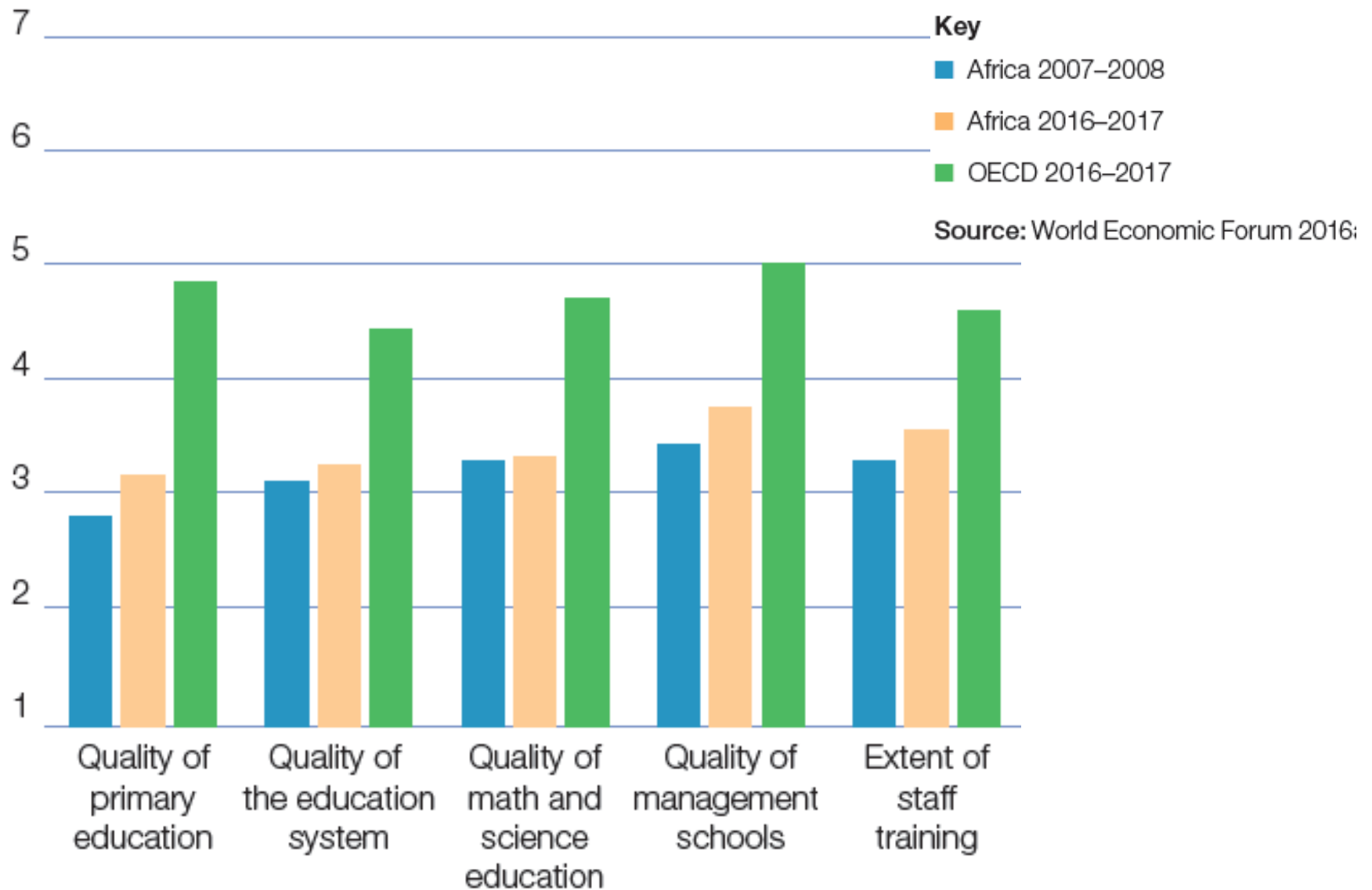
Key

- Africa 2007-2008
- Africa 2016-2017
- OECD 2016-2017

Source: World Economic Forum 2016;

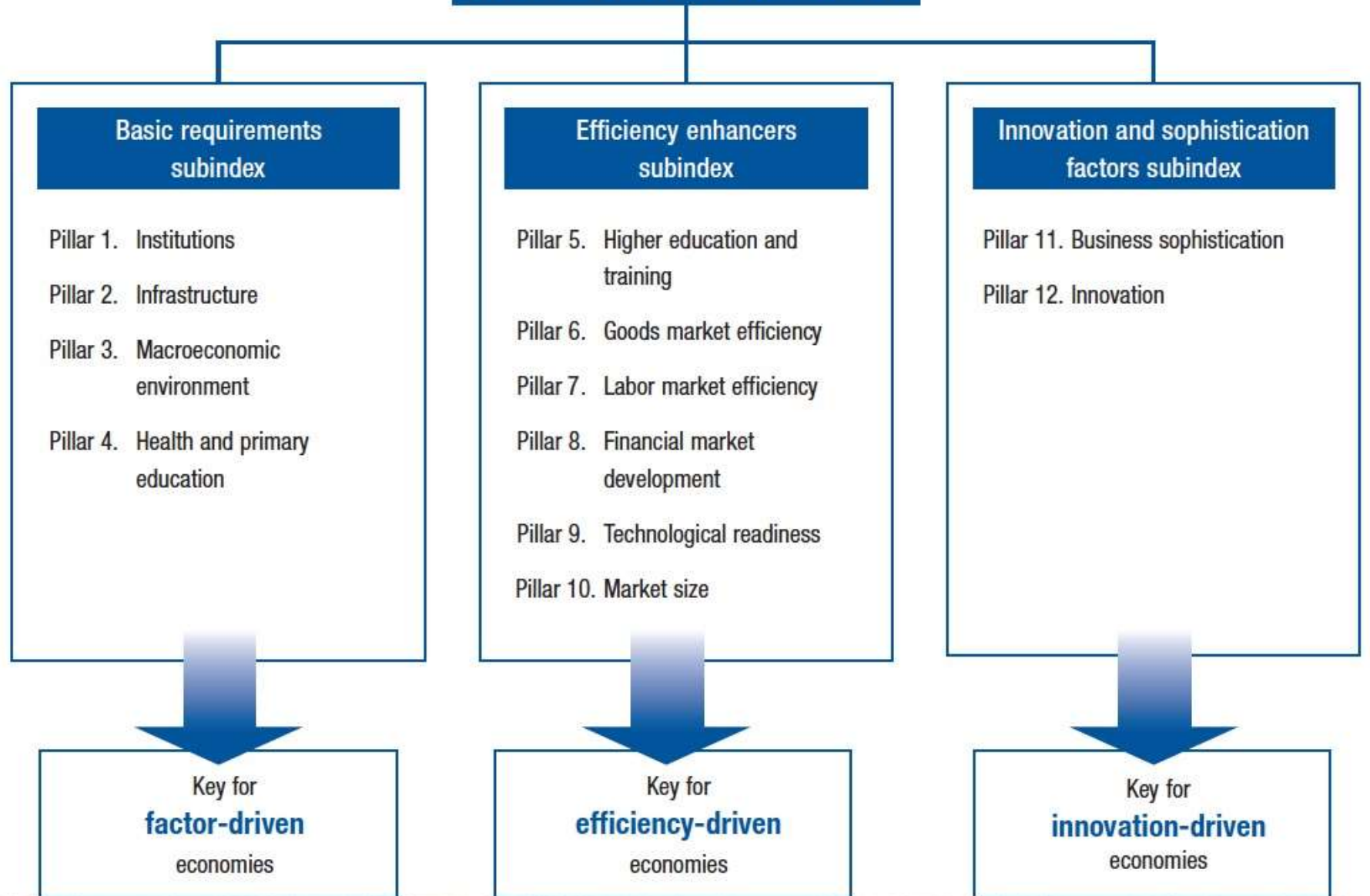
# Education QUALITY comparisons

Score (1–7 scale)



Each year the World Economic Forum publishes a report that ranks the 137 member countries in relation to their stage of development

## GLOBAL COMPETITIVENESS INDEX



# World Economic Forum

## Global Competitiveness Ranking 2017/8

Rank	Score	Trend in year
1. Switzerland	5.86	=*
8. UK	5.51	↓*
45. Mauritius	4.52	=*
<b>58. Rwanda</b>	<b>4.35</b>	↓
<b>61. South Africa</b>	<b>4.32</b>	↓
63. Botswana	4.30	↑*
<b>111. Ghana</b>	<b>3.72</b>	↑*
<b>113. Tanzania</b>	<b>3.71</b>	↑*
114. Uganda	3.70	↓*
125. Nigeria	3.30	↑
136. Mozambique	2.89	↓
137. Yemen	2.87	=*

*Based on effectiveness of institutions, policies and factors that determine the level of productivity.*

**Key:**

↑ ↓ Change in rank order  
\* Raised score in index

## COMPARISON OF EDUCATION SYSTEMS IN SOUTH AFRICA, GHANA, RWANDA AND TANZANIA

<b>WORLD ECONOMIC FORUM GLOBAL COMPETITIVENESS REPORT 2017/8</b>				
<b>PILLARS 4 &amp; 5</b>	<b>RANKING OUT OF 137 COUNTRIES</b>			
	S. AFRICA	GHANA	RWANDA	TANZANIA
Quality of primary education	116	96	53	117
Primary education enrolment rate	50	110	70	124
Secondary education enrolment rate	54	105	128	131
Tertiary education enrolment rate	99	102	120	131
Quality of the education system	114	48	38	90
Quality of mathematics & science education	128	90	55	119
Quality of school management	45	48	56	119
Internet access to schools	95	87	54	122
Local availability of specialised training services	54	47	71	96
Extent of staff training	39	67	46	108

BANTU EDUCATION ACT 1953      HENDRIK VERVOERD

"There is no place for [the Bantu] in the European community above the level of certain forms of labour ... What is the use of teaching the Bantu child mathematics when it cannot use it in practice?"

# Teaching Methodology for The Competences Based Curriculum

In every sphere of human activity  
technology is changing the world.

Much of the knowledge and skills  
needed in the last century  
is obsolete or inadequate today.

Knowledge of facts  
Algorithms

Machines are superior to people

Generic competences promote the development of  
**higher order thinking skills** helping students to  
**deepen their understanding** of subjects and  
**apply their subject learning** in a range of situations.

# Teaching Methodology for The Competences Based Curriculum

- Critical/Mathematical Thinking
- Logical reasoning
- Creativity and innovation
- Research and problem solving
- Communication
- Co-operation, interpersonal relations and life skills
- Independent learning/Life long learning

Mathematics provides ideal learning experiences for the development of these (generic) competences.



# Plan for inquiry based learning

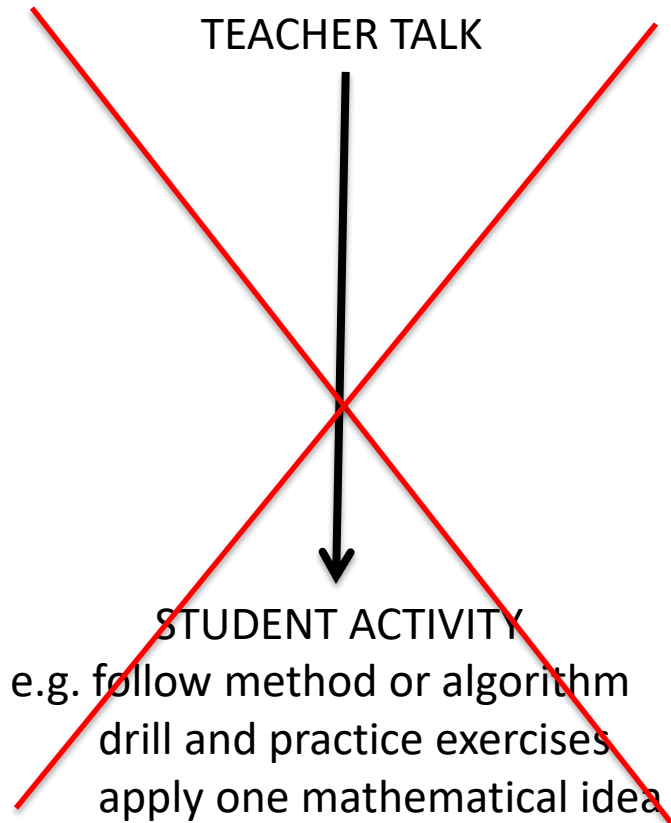
I hear and I forget  
I see and I understand  
I do and I remember



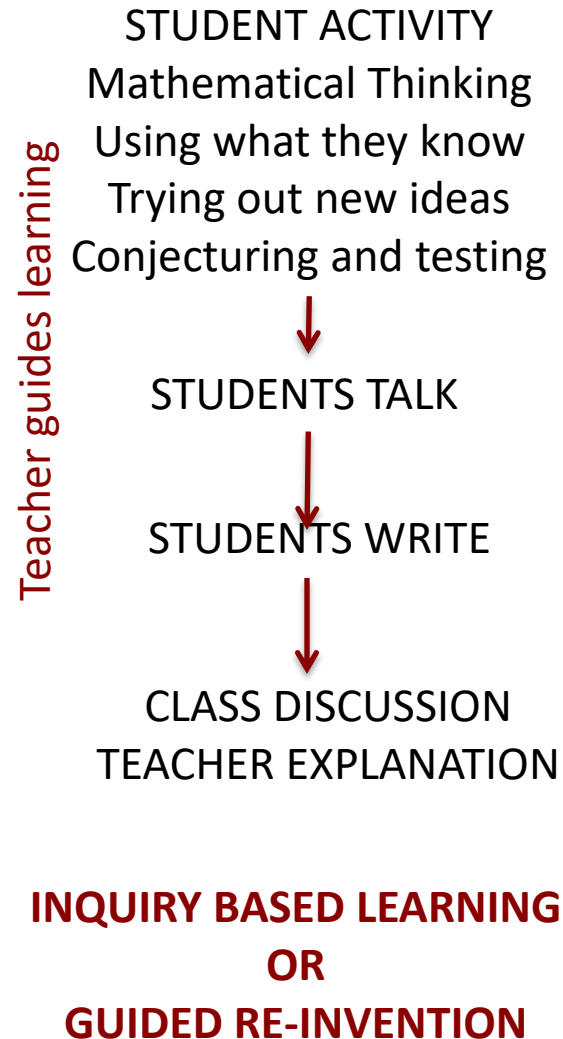
Ancient Chinese proverb.



## 19<sup>th</sup> century teaching method



## 21<sup>st</sup> century teaching method

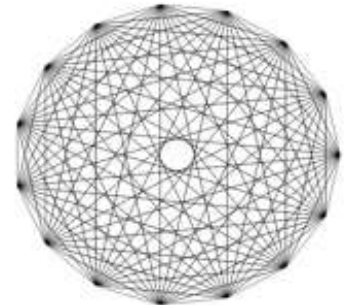
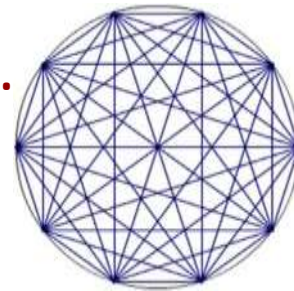


## HANDSHAKES AT KINGANI SCHOOL, BAGAMOYO, TANZANIA P2

LEARNING: Problem solving; Visualising number patterns; Finding formulae; Summing series; Generalising; Connecting concepts; Isomorphism; Mathematical induction.



**EVERYONE SHAKES HANDS WITH EVERYONE ELSE.  
HOW MANY HANDSHAKES?**



## HANDSHAKES AT KINGANI SCHOOL, BAGAMOYO, TANZANIA P2

LEARNING: Problem solving; Visualising number patterns; Finding formulae; Summing series; Generalising; Connecting concepts; Isomorphism; Mathematical induction.



RELATED ACTIVITIES ON THE AIMING  
HIGH TEACHER NETWORK WEBSITE

[MYSTIC ROSE](#)

[TRIANGLE NUMBER PICTURE](#)

[CLEVER CARL](#)

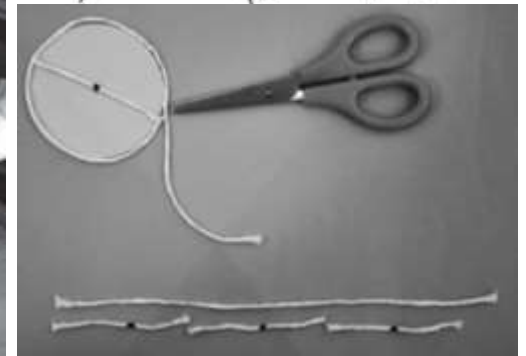
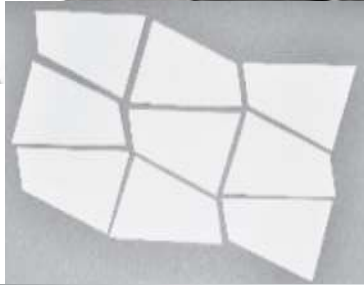
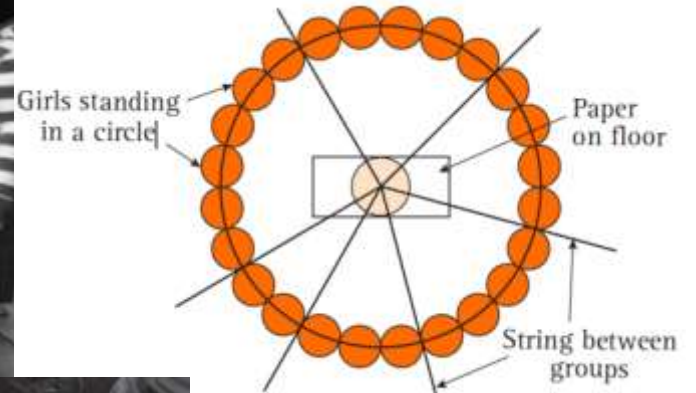
THESE AND MORE FREE RESOURCES FOR  
THE COMPETENCY BASED CURRICULUM

<http://aiminghigh.aimssec.ac.za>

and on <http://nrich.maths.org>

# COST FREE OR LOW COST MANIPULATIVES

e.g. Beans  
String  
Scrap paper & card  
Empty containers



## STUDENTS GIVING FEEDBACK

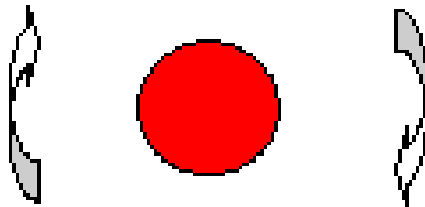


**SHOWBOARDS** – laminated A4 sheets of paper – blank one side – square grid other side

# INITIAL TRAINING AND CONTINUING PROFESSIONAL DEVELOPMENT



Shortage of  
mathematically  
trained teachers



Lack of  
opportunity  
for learners

To help to break the vicious circle AIMSSEC re-trains experienced inservice teachers.



The AIMSSEC model, provides continuing professional development for teachers together with a support network. It extends to other African countries through AIMSNEI and other collaborations.

# AIMING HIGH NETWORK

A cascade model to reach many schools and many learners particularly in rural areas.

A teacher network across Africa for mutual support to learn together and to share information and e-resources.



To empower teachers to improve mathematics education in their own communities.

To engage teachers as lifelong learners committed to sharing ideas and improving teaching.

# AIMSSEC Seeks to Empower Teachers



## A Cascade Effect

### **AIMSSEC offers accredited professional development courses**

- serving teachers in townships and rural communities
- focussing on subject knowledge and pedagogy
- promoting the idea that teachers have a responsibility to continue learning throughout their careers
- sharing resources for activity based learning
- training teachers to be subject leaders
- training teachers to run workshops for other teachers

### **Three stage AIMSSEC programme:**

1. Preliminary 3 month Mathematical Thinking Course
2. Two year ACE in Mathematics with Training for Subject Leaders
3. Continuing Professional Development through AIMING HIGH Network







**AIMSSEC**

# Mathematical Thinking Course

- Presented 27 times
- 10-day residential course in school holidays
- Followed by 3-month distance learning
- 1805 teachers & mathematics advisers
- 65 hours face-to-face teaching, exam & assignments
- Taught by the AIMSSEC African Team including former AIMSSEC students, together with an international team of unpaid volunteer lecturers



**AIMSSEC**

# Advanced Certificate in Teaching

- 2 year part time course
- 204 teachers & subject advisers graduated
- More than 50% women
- Residential units, home study, assignments & exams
- TV broadcast workshops
- 71 graduates in partnership with Stellenbosch University
- 133 graduates in partnership with Fort Hare University

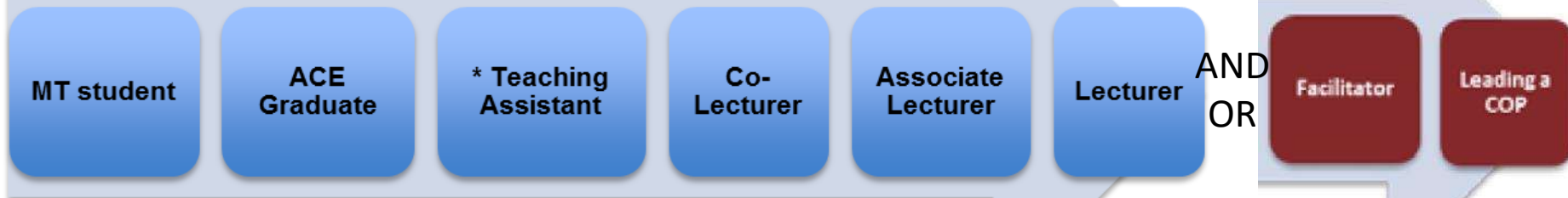


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## AIMSSEC alumni

PATHWAYS FOR AIMSSEC ALUMNI TO LECTURING AND LEADERSHIP IN THEIR HOME AREA



Principal



Lead teacher



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## Book series for teachers

1<sup>st</sup> in series for Lower Secondary

Published by Cambridge University Press

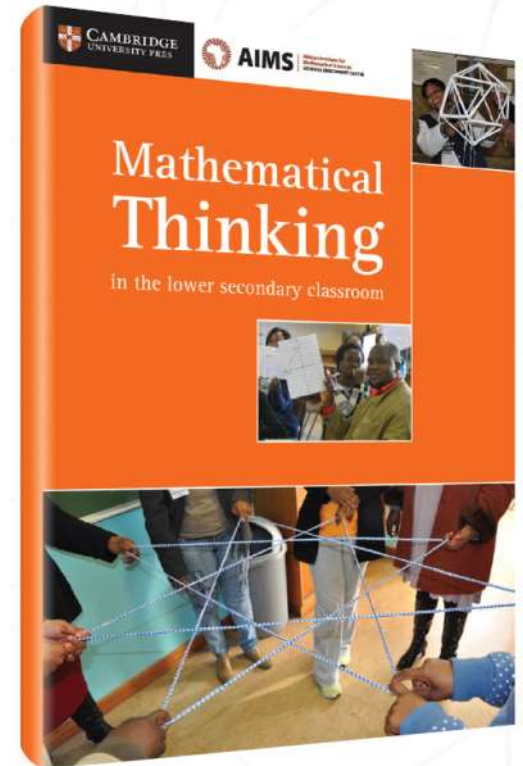
Collaborative learning amongst teachers

Low cost, no royalties

Trialled by teachers across South Africa

Upper Primary and Upper Secondary to follow

With curriculum maps for different countries



Available in Rwanda from: School Book Distributors, Arthur Barigye

[bmkarthur@yahoo.co.uk](mailto:bmkarthur@yahoo.co.uk); +250 788522495. RWF 9,500 + local taxes

Order online from <http://cambridge.org/aimssecmaths/>



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Mathematical Thinking course:

<https://www.youtube.com/watch?v=BziFeIBkn9Q>

Free mathematical thinking resources:

<http://aiminghigh.aimssec.ac.za>

AIMSSEC Website:

<http://aimssec.ac.za>

AIMSSEC Academic Director

Barrie Barnard [barrie@aimssec.ac.za](mailto:barrie@aimssec.ac.za)



# Employment growth 2000 -16

Kigali 10.3%

Dar Es Salaam 5.8%

Johannesburg 1.7%

Cape Town 1.1%

Kimberley – 0.7%

Port Elizabeth – 0.9%