

Faculty of Science

*Discovering for tomorrow*



Govan Mbeki Mathematics Development Unit

# PROGRAMME & OVERVIEW OF PROJECTS



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October 2014



Govan Mbeki Mathematics  
Development Unit

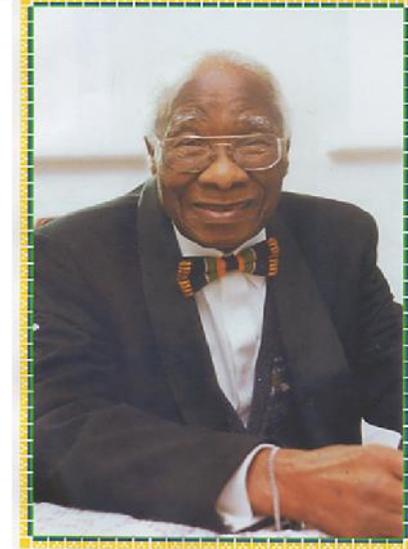
*empowering young minds*

# Historic Perspective

## Govan Mbeki Mathematics Development Programme In Science Faculty since 2002



*"Our South African youth must study  
Mathematics and Science in order for us to be a  
winning nation."*



**Dr Govan Mbeki  
(LLD)**

**Officially an Engagement  
Unit Since 2008**

# **GMMDU Vision and Mission:**

- **Improvement of the quality of Mathematics and Science teaching and learning at secondary school and FET college level in the Eastern Cape Province (ECP) and beyond;**
- **Effective integration of relevant 21<sup>st</sup> century technologies in the teaching and learning of FET Mathematics and Science;**
- **Improved public awareness of the important role Mathematics and Science play in modern society.**

# **GMMDU Objectives:**

## **The unit aims to:**

- Improve the content knowledge, problem solving and teaching skills of in-service Mathematics and Physical Sciences educators at previously disadvantaged secondary schools and at FET colleges;**
- Improve the National Senior Certificate Mathematics and Science pass rates and quality of passes amongst learners in previously disadvantaged secondary schools;**
- Develop appropriate 21st-century off-line techno-blended T&L scaffolding support models and accompanying resource material for the teaching and learning of FET Mathematics and Physical Sciences.**

# Current Critical NCS Maths Scenario in SA Secondary Schools

- Learner attainment:**  
Poor Quality and Number of Maths Passes

Result:	Mathematics Results by Province - 2012										
	Pass Rate	0-9%	10-19%	20-29%	30-39%	40-49%	50-59%	60-69%	70-79%	80-89%	90-100%
NATIONAL	54%	8%	19%	19%	18%	13%	9%	6%	4%	2%	1%
EASTERN CAPE	38%	16%	26%	20%	16%	10%	6%	3%	2%	1%	0%
FREE STATE	65%	3%	13%	19%	22%	16%	11%	8%	5%	3%	1%
GAUTENG	71%	3%	11%	15%	19%	16%	14%	10%	7%	4%	1%
KWAZULU-NATAL	48%	9%	22%	21%	19%	12%	8%	5%	3%	2%	1%
LIMPOPO	52%	9%	20%	19%	18%	13%	9%	6%	3%	2%	1%
MPUMALANGA	53%	9%	18%	20%	18%	14%	9%	6%	4%	2%	0%
NORTH WEST	60%	4%	16%	20%	22%	14%	10%	7%	4%	2%	0%
NORTHERN CAPE	55%	6%	19%	21%	18%	13%	9%	7%	4%	2%	0%
WESTERN CAPE	73%	2%	10%	14%	17%	15%	13%	11%	9%	6%	2%

Grade 4			Grade 8		Grade 12		
Rank	Nation	Score	Nation	Score	Nation	Score	
1.	Singapore	625	Singapore	643	Netherlands	560	
2.	Korea	611	Korea	607	Sweden	552	
3.	Japan	597	Japan	605	Denmark	547	
4.	Hong Kong	587	Hong Kong	588	Switzerland	540	
5.	Netherlands	577	Belgium	565	Iceland	534	
6.	Czech Republic	567	Czech Republic	564	Norway	528	
7.	Austria	559	Slovak Republic	547	France	523	
8.	Slovenia	552	Switzerland	545	New Zealand	522	
9.	Ireland	550	Netherlands	541	Australia	522	
10.	Hungary	548	Slovenia	541	Canada	519	
11.	Australia	546	Bulgaria	540	Austria	518	
12.	United States	545	Austria	539	Slovenia	512	
13.	Canada	532	France	538	Germany	495	
14.	Israel	531	Hungary	537	Hungary	483	
15.	Latvia	525	Russian Fed.	535	Italy	476	
16.	Scotland	520	Australia	530	Russian Fed.	471	
17.	England	513	Ireland	527	Lithuania	469	
18.	Cyprus	502	Canada	527	Czech Republic	466	
19.	Norway	502	Belgium	526	United States	461	
20.	New Zealand	499	Sweden	519	Cyprus	446	
21.	Greece	492	Thailand	522	South Africa	356	
22.	Thailand	490	Israel	522			
23.	Portugal	475	Germany	509			
24.	Iceland	474	New Zealand	508			
25.	Iran	429	England	506			
26.	Kuwait	400	Norway	503			
27.			Denmark	502			
28.			United States	500			
29.			Scotland	498			
30.			Latvia	493			
31.			Spain	487			
32.			Iceland	487			
33.			Greece	484			
34.			Romania	482			
35.			Lithuania	477			
36.			Cyprus	474			
37.			Portugal	454			
38.			Iran	428			
39.			Kuwait	392			
40.			Colombia	385			
41.			South Africa	354			
Grade Average		529	Grade Average		512	Grade Average	500

- TIMSS & ANAS International Ratings:**



South Africa comes last in maths education: survey

Sapa | 01 November, 2012 11:01



**TIMSS**

# Current NCS Maths School Scenario in SA

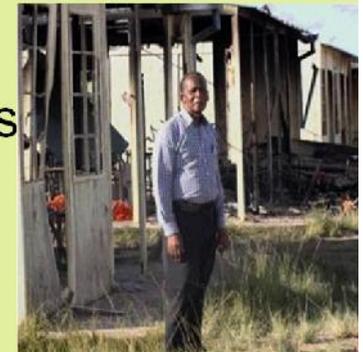
- **Teacher Shortage:** South Africa cannot continue to rely solely on current systems to train more and better teachers CDE, 2011.

## Teacher shortage crisis affects half SA's schools

JUN 18, 2012 | TEBOGO MONAMA EDUCATION REPORTER | 3 COMMENTS



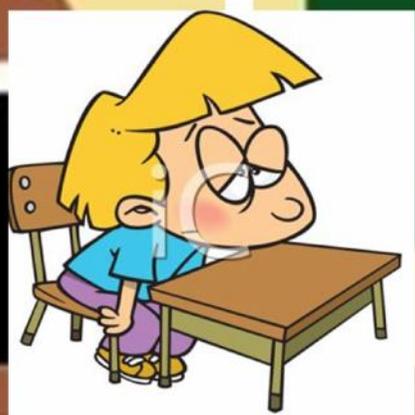
- **Teacher Qualifications:** less than 60% of mathematics had completed a degree (vs 87% avg. internationally)
- **Teacher Practice and Motivation:** Absence from class rooms previously disadvantaged schools result in loss of 3 years of teaching time (out of 12 years) – *HSRC report*
- **School Infra-structure:** Thousands of schools in South Africa lack the infrastructure necessary to provide learners with the quality education which they are legally entitled to receive
  - *Equal Education Campaign - 2013*
- **T&L Resources:** Each year thousands of learners are without textbooks and access to libraries etc.



# Urgent Need to Challenge an Inadequate Teacher Centred Maths and Science Teaching Model

What's on the blackboard

$12\sqrt{6} \cdot 7 : (6+2\sqrt{4}) \cdot 2 + ab - c \cdot 145\sqrt{}$   
 $1 + -5x + 6y \cdot 22\sqrt{4d} + 2\sqrt{r} : (3 + [8\sqrt{}$   
 $2] : 3 + 2\sqrt{) \cdot 34\sqrt{4u} \cdot 3ea^*$



What the teacher is seeing

$$2 + 2 = 4$$

What the students are seeing

而不是鍵入一個美好的譯員  
胡說我有一個夢想，夢想雞E  
話'的事情在衣櫃裡，他媽的給  
儲到有經驗的獵人阿哈小姐

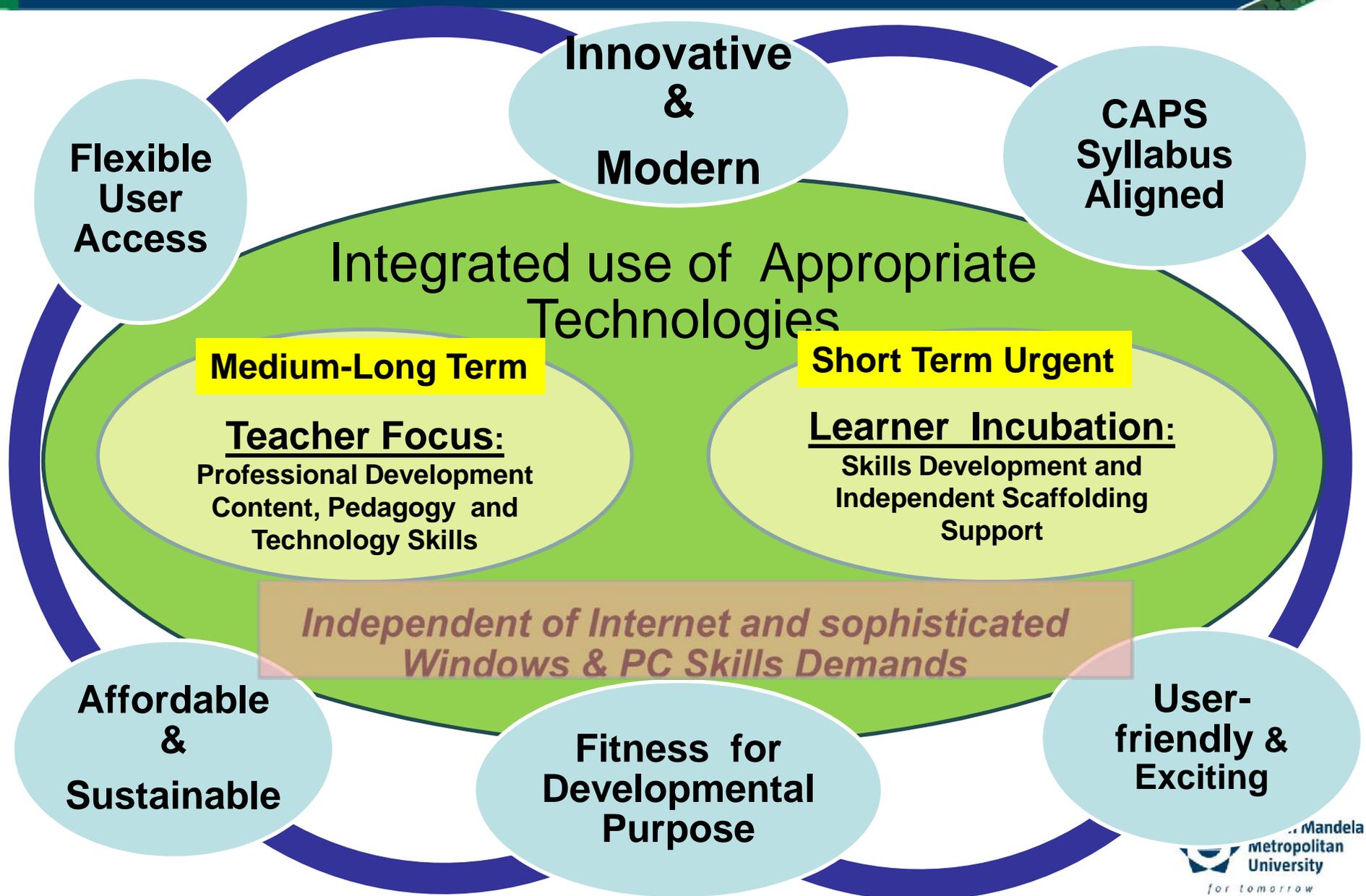
What the students remember



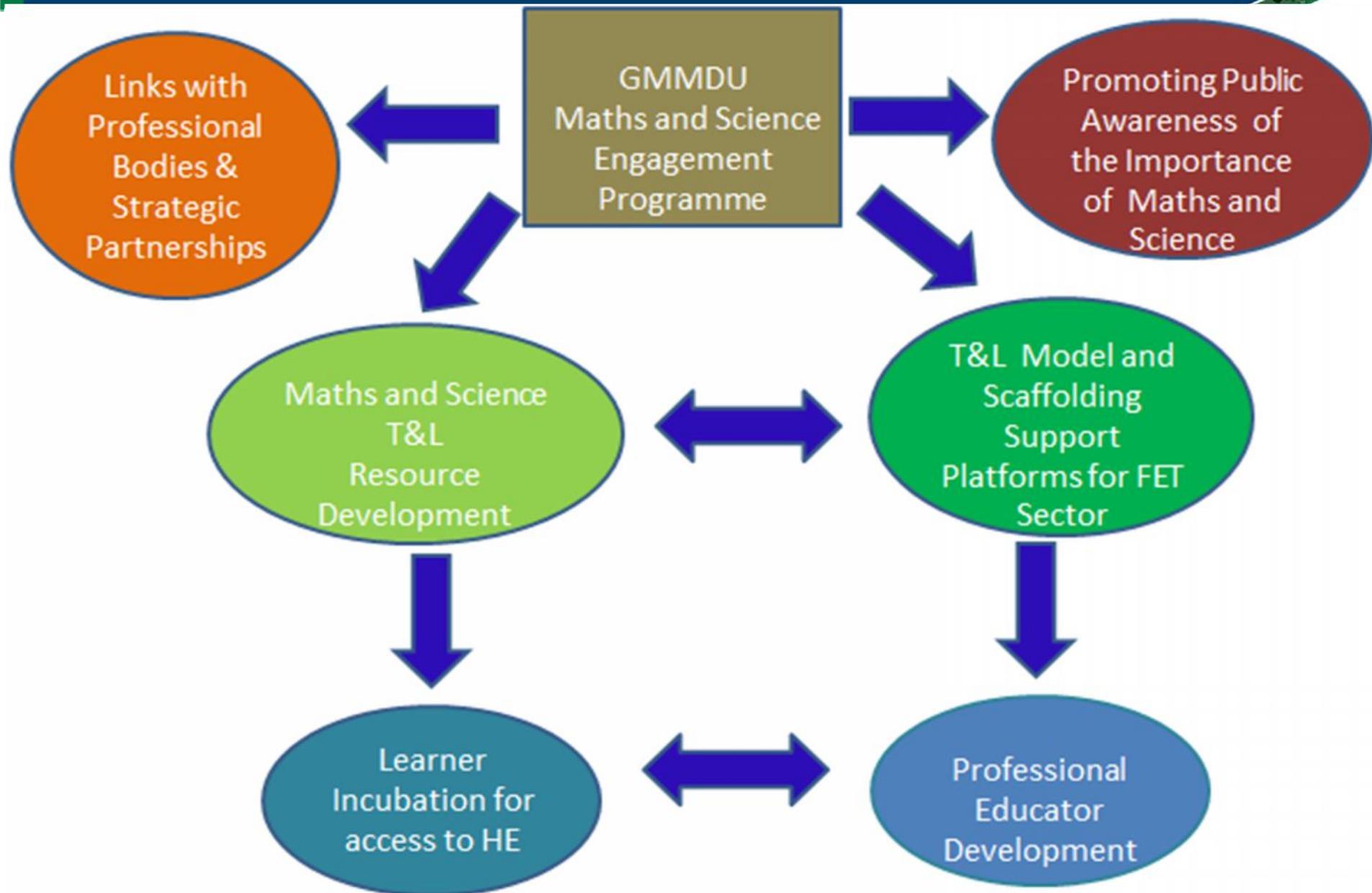
Too much talk – Too little action!



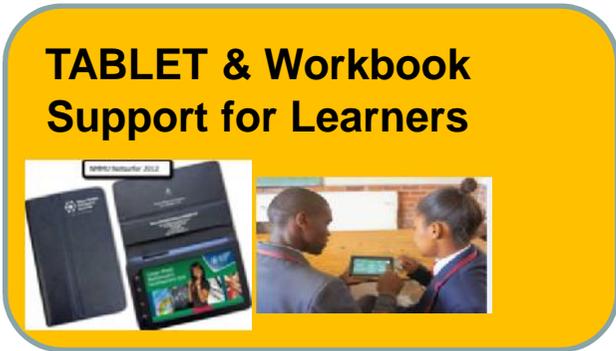
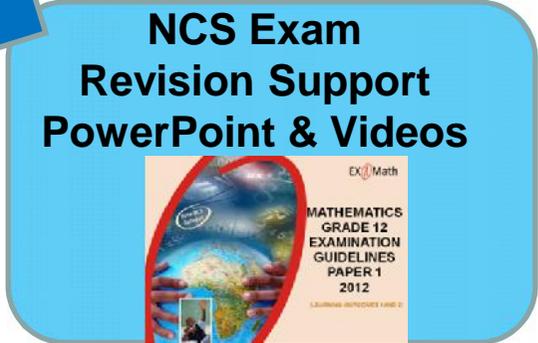
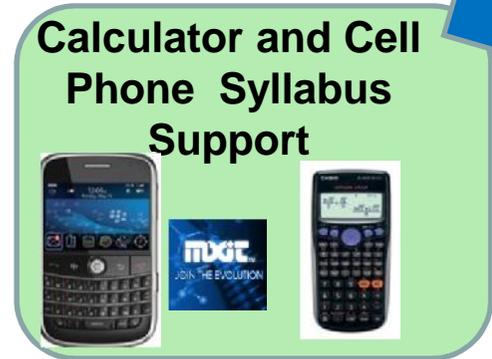
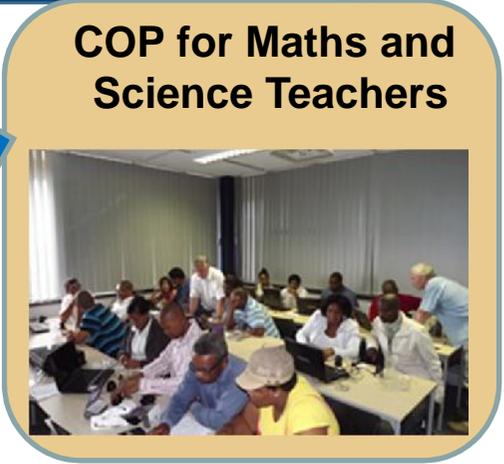
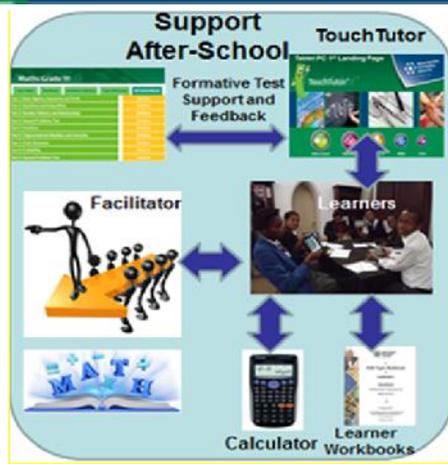
# Framework for a successful 21<sup>st</sup> century FET Maths & Science T&L Model in SA Schools



# GMMDU Development Project Framework:

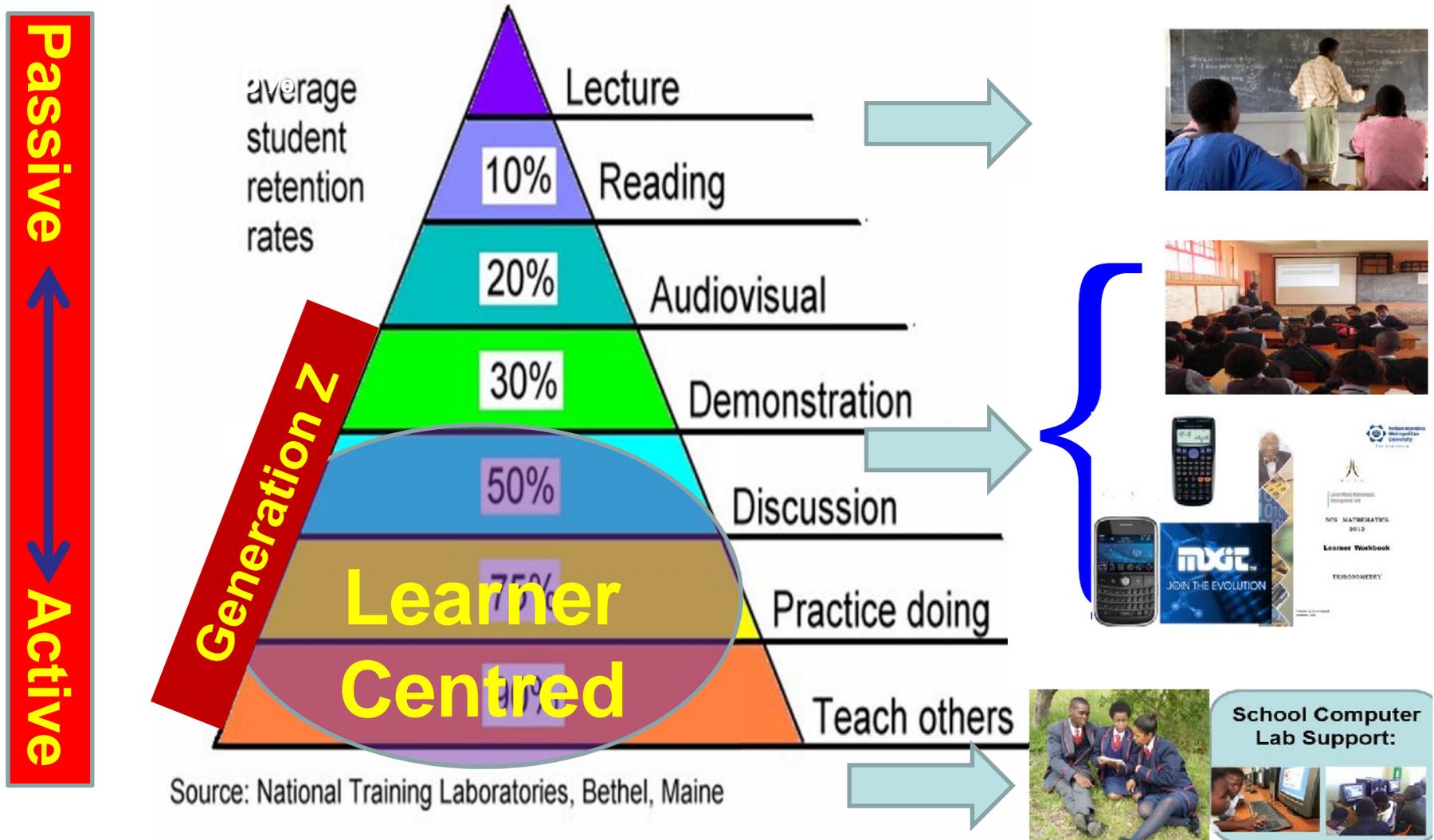


# Integrated Offline Techno-Blended Maths and Science T&L Support Model for Secondary Schools



# Techno Blended Model vs the Learning Pyramid

## Learning Pyramid



# Recent GMMDU Project Implementations

## Accredited FET Math & Science Skills Upgrade of In-service Educators



2012-2014

- Two NMMU SAQA Accredited Short Learning Programmes
- One-year Curriculum Aligned Maths or Science Training
- Comprehensive Equipment and T&L Material Distribution
- Certification in Partnership with ETDP SETA & DBE

Accredited Mathematics Skills Training  
2012



Subject Advisors and the Dinaledi  
School Teachers Training



Maths and Science Educator and  
College Lecturer Training - 2013



# Recent Project Implementations: 2012-2014

## Provincial Training of Educators - ECP & Free State



SAASTA Maths & Science Teacher Training



Dinatedi Maths & Science Teacher Training



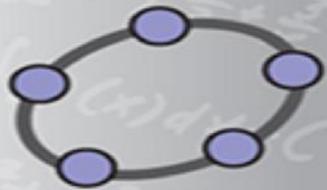
Certification – MEC & DBE ECP Leadership



Maths & Science Subject Advisors

**>700 Educators Successfully Completed Skills Upgrade Programme, Received Laptops & TouchTutor Resource Materials**

**GMMDU Project Implementations: 2010-2014**  
**GeoGebra Institute – Maths Support for Maths Educators**



**GeoGebra@NMMU**

**GeoGebra is an exciting Open Source Dynamic Graphics Software Programme for Teaching and Learning of Mathematics with strong international community support.**

■ **Maths Teacher training and support in the ECP**

- Content, Technology & Pedagogy Skills transfer

■ **Maths Lesson and Assessment Material**

- Sharing GeoGebra materials and ideas for best practice

■ **Professional Maths Learning Communities**

- Teacher Workshops and Annual conferences
- GeoGebra User - Maths Teacher Certification
- Learner Support – GeoGebra Clubs at Schools

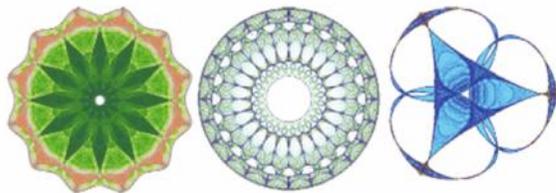
# Successful Annual Regional Conferences @ NMMU



**GeoGebra Conference**  
2 - 3 April 2012

Nelson Mandela Metropolitan University  
Port Elizabeth

*Africa's first GeoGebra conference*



sponsored and supported by:



**GeoGebra Conference**  
20 - 21 September 2013

Friday 13h00-17h00 & Saturday 08h00-17h00

Nelson Mandela Metropolitan University  
Port Elizabeth

**FIRST ANNOUNCEMENT**

**PLENARY SPEAKERS**

Balázs Koren, CEO of GeoGebra Hungary LLC, the base for community management.  
Gerrit Stols, Chair of GeoGebra Institute at the University of Pretoria

**THEME**

Mathematical discovery and learning through dynamic graphics



**GeoGebra Conference**  
3 - 4 October 2014

Pre Conference WORKSHOP, 2 October, 14h00 - 18h00  
*for delegates with no previous exposure to GeoGebra*

Nelson Mandela Metropolitan University  
Port Elizabeth

**FIRST ANNOUNCEMENT**

**PLENARY SPEAKERS**

Prof Gerrit Stols  
University of Pretoria

Prof Werner Olivier & Dr Phil Collett  
GMMDU, NMMU

**THEME**

GeoGebra for Curriculum Support  
in the 21<sup>st</sup> Century Mathematics  
Classroom



Pre-conference workshop: For delegates with no previous experience in GeoGebra; no charge  
Conference cost: R250 which includes a conference dinner

GeoGebra Conference Delegates - April 2012



GeoGebra Conference 2013



GeoGebra Conference 2014

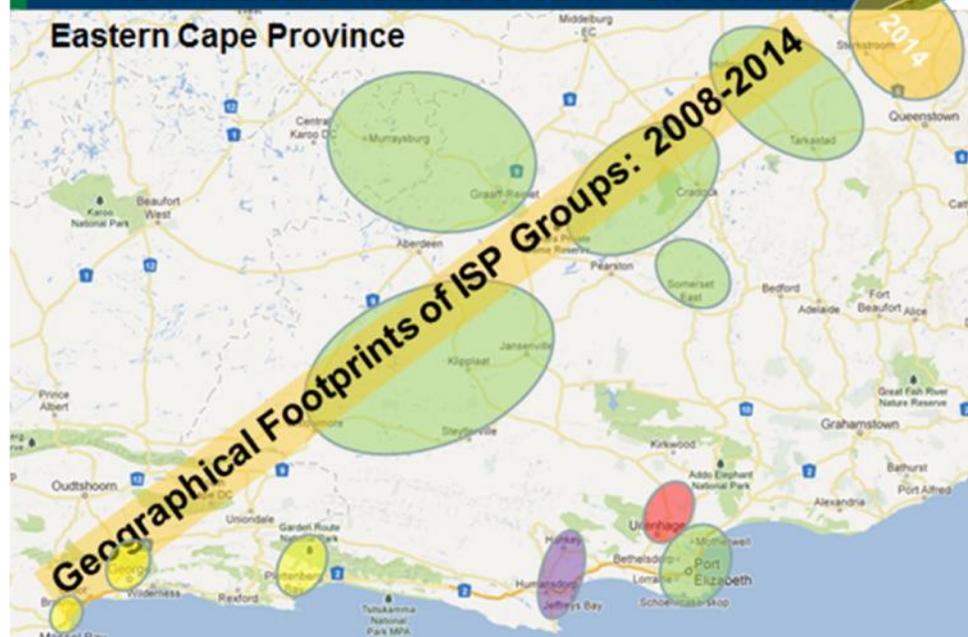


# GMMDU Project Implementations: 2010-2014

## Incubation of Math & Science Learners with Potential

- 15 Saturday Maths and Science Incubation Programme – Grades 11&12 learners ( more than 500 in total per year)
- Structured facilitation using Video & PowerPoint lessons
- Tablet, TouchTutor package & Calculator support
- Tablet based assessment and Mxit based self tests
- Certification, prizes and bursaries for selected learners

**GMMDU Saturday Incubator School Programmes for selected learners from > 80 schools**



**2013 Tablet Assisted Incubator Schools for Grade 11&12 Learners with Potential**

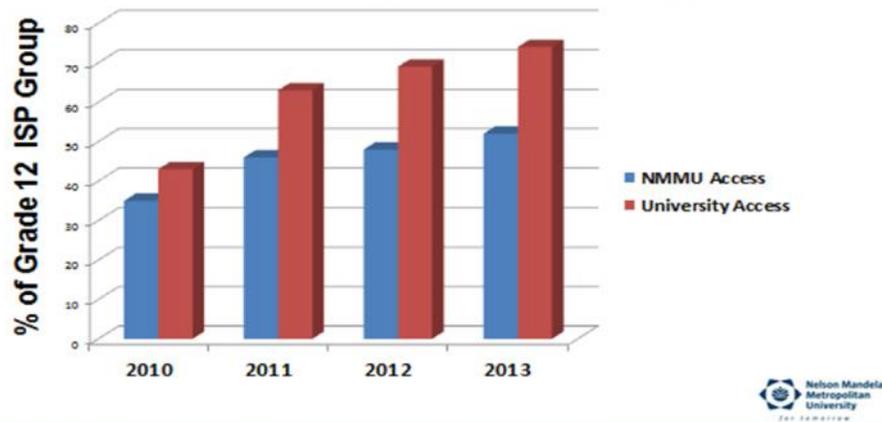


# National Award for the Tablet based Maths and Science Incubator School Programme

## Successful Learners Incubation for HE

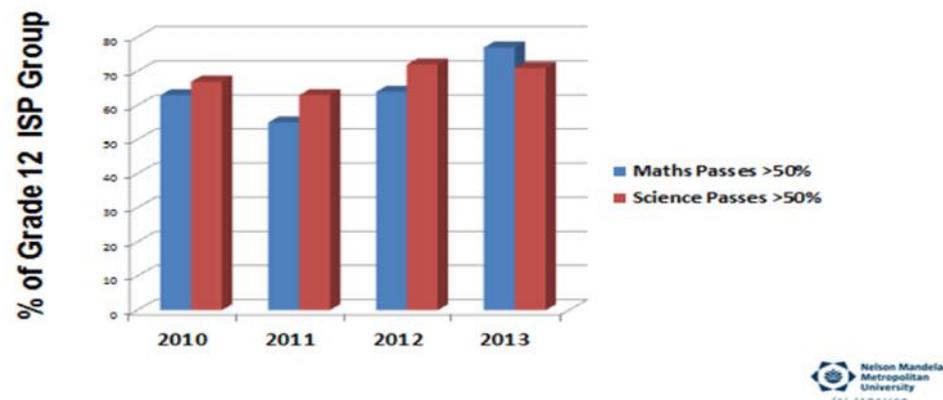
### NMM ISP Group: Successful University Access 2010-2013

PE ISP: Annual Progressed to University



### NMM ISP Groups: Quality of Maths and Science Passes: 2010-2013

PE ISP: Annual % Maths and Science Passes >50%



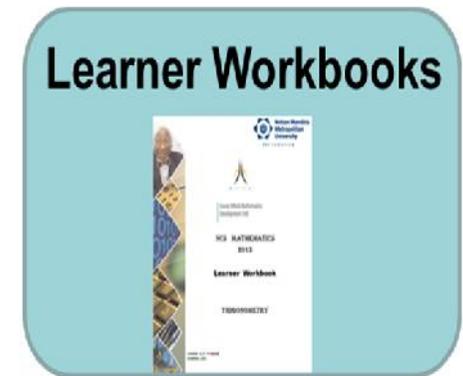
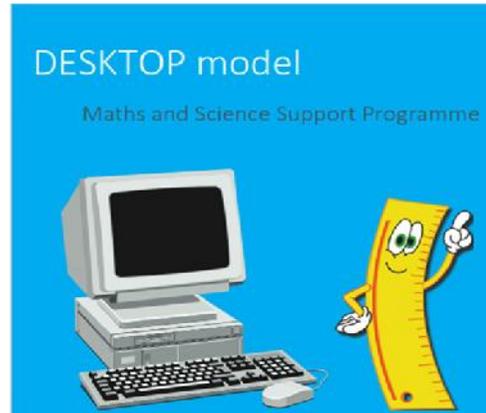
## Baxter Theatre, Rondebosch CPT December 2013



Min. Derek Hanekom, Prof Jonathan Jansen



# GMMDU Project Implementations: 2010-2014 Maths and Science Desktop Resource Centres in Schools



- Dedicated resources under control of Maths & Science Teachers
- School based access to quality content support material
- Learner workbooks for individual practice or peer-support
- Two desktops per school >80 schools in 4 districts in 2014



# Recent GMMDU Project Implementations: 2013-2014 R&D of Mxit based Applications and T&L Material



Provincial Pilot in 2013 & 2014

- School Maths and Science competitions on Mxit
- Curriculum aligned Grades 10-12 Maths and Science multiple choice tests, scores, solutions and feedback
- School Maths and Science & Olympiad type problems
- Flexible and affordable Maths and Science learner support



# NCS Maths and Science material for student support at NMMU

Nelson Mandela Metropolitan University  
student portal

Official staff Student staff Computer Staff Online forms Internal sites Public sites

Academic integrity: Do not place your future at risk.

Download on the App Store  
BlackBerry App World  
ANDROID APP ON Google play

Shuttle Service Schedule 2014

SOAPBOX student life @ NMMU VISION 2020 VWSA DAAD Wi Fi NCS Maths & Science

NCS Maths & Physical Science Teaching and Learning Centre

Govan Mbeki Mathematics Development Unit

Nelson Mandela Metropolitan University

HOME MATHS CONTENT SCIENCE CONTENT PHYSICAL SCIENCE EXPERIMENTS CONTACT US ABOUT US

Welcome to the GMMDU Maths & Physical Science content teaching and learning material.

Each of the presentation series listed below represents an important component of a new and exciting blended teaching and learning model based on the use of modern instructional technologies.

## CAPS Mathematics Content Series

The various sections of the Grade 10, 11 & 12 CAPS Maths syllabus are presented in a structured way using the latest audio-graphical media. Several micro-lessons in each of the self-contained topic presentations will cover relevant CAPS Maths concepts, results, examples and tutorial problems.

## NCS Physical Science Content Series

The Grade 11 & 12 NCS Physical Science syllabus is presented in a structured way using the latest audio-graphical media. Several micro-lessons in each of the self-contained topic presentations will cover relevant NCS Physical Science concepts, results, examples and tutorial problems. CAPS upgrades to the material are in progress.

## NCS Physical Science Experiment Series

The experiments of the NCS Physical Science syllabus are presented in a structured way using professionally produced video recordings that were made in a state-of-the-art laboratory. All experiments are contextualized using pre-discussions and post-discussions linked to the Physical Science content presentation series. This exciting series can be utilized as a Virtual Laboratory to accompany the implementation of the NCS Physical Science curriculum.

## Maths National Exam Series

Complete discussions and explanations of the national Grade 12 NCS Maths examinations question papers for the period 2008-2012 are presented. This series is particularly valuable as a basis for reflection and revision in the period leading up to final Mathematics examinations.

## Mathematics using CASIO Series

A series of two presentations on how to utilize the calculator to solve maths problems is linked to the learning outcomes of the NCS Mathematics Syllabus. Each presentation demonstrates step-by-step how the FX 82 ES / ZA Plus calculator can be utilized as a tool to enhance the teaching and learning of Maths in the classroom or elsewhere.



Application Linked to Student Portal

# Challenges

- **Infra-structure support from the NMMU**
- **Affordability of staff – planning for sustainable growth**
- **One-year project funding cycles – Permanent Posts**

## Future Plans – On-going R&D

- **Interactive multiple choice assessment alongside TouchTutor on Tablets**
- **GeoGebra certification for in-service Maths educators**
- **Extensions of Mxit competition and curriculum support projects for schools in collaboration with Mxit Reach**
- **Automatic logging of TouchTutor usage data and extraction of user profile from Tablets and Laptop devices**
- **Further commercialization of TouchTutor resource material**
- **Closer project collaboration with academic structures internal to the NMMU ( e.g IT and Education)**
- **More structured participatory action research linked to implementations of techno-blended T&L model**

# Strategic External R&D partnerships: 2012-2014



education

Department of  
Education  
FREE STATE PROVINCE



CSIR  
meraka



Province of the  
**EASTERN CAPE**  
EDUCATION

GeoGebra

**FUTUREMOBILETECHNOLOGY**  
CONNECTING YOU TO THE WORLD



**merSETA**  
MANUFACTURING, ENGINEERING  
AND RELATED SERVICES SETA

World Vision  
South Africa



**ETDP-SETA**

**NORDEX**  
We've got the power.

**cennergi**  
POWERING PROGRESS

**Vargatex**

**OLD MUTUAL**

**axium**



**RAND  
MERCHANT  
BANK**  
A division of FirstRand Bank Limited



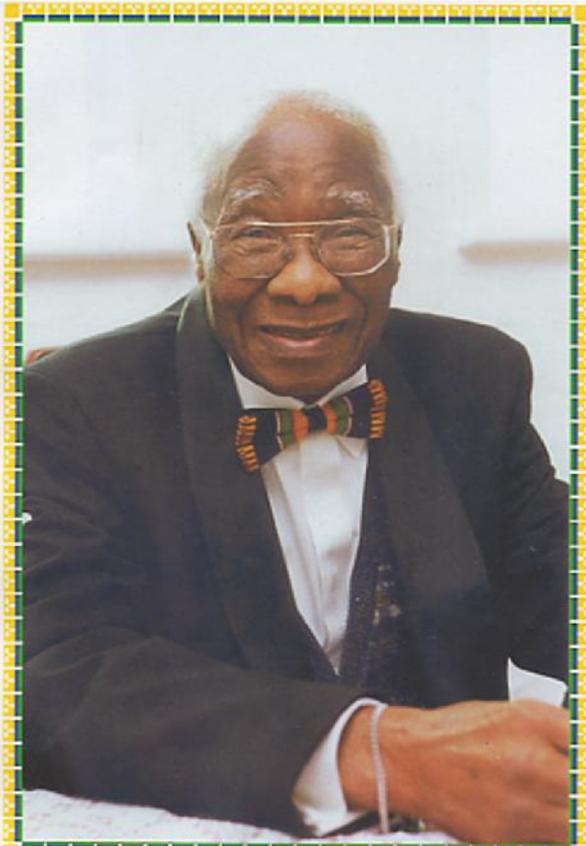
**SAASTA**  
SOUTH AFRICAN AGENCY FOR SCIENCE  
AND TECHNOLOGY ADVANCEMENT

**reach**

**Sanlam CASIO**

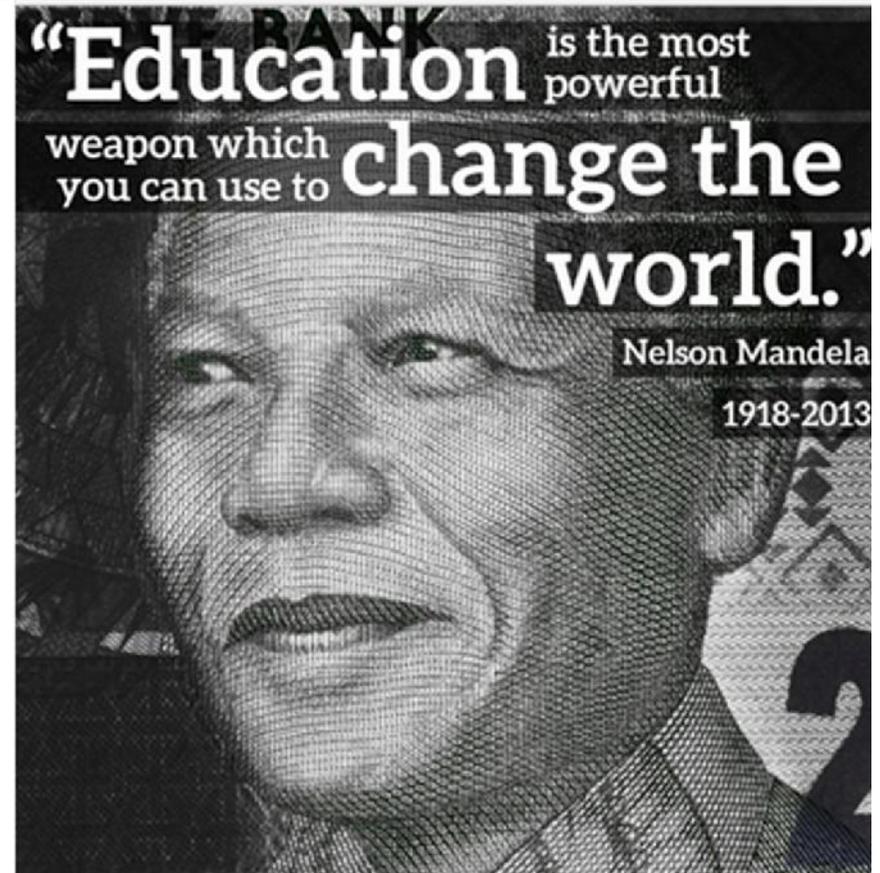
**sasol**  
reaching new frontiers

# Thank You for your Time



**Dr Govan Mbeki (LLD)**

*"Our South African youth must study Mathematics and Science in order for us to be a winning nation."*



[mbeki-maths-dev.nmmu.ac.za](http://mbeki-maths-dev.nmmu.ac.za)