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NEWS

Nelson Mandela Metropolitan University
for tomorrow
Port Elizabeth & George

GMMDU Newsletter

Govan Mbeki Maths Development Unit

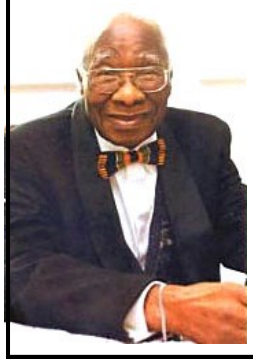
Editorial

The first half of 2015 saw a number of exciting learner and teacher development project implementations in an ever-expanding selection of under-resourced secondary schools across the Eastern Cape Province. This is a result of a growing partnership with the DBE and a network of officials and other education stakeholders both inside and external to the NMMU.

Various additional digitally–assisted support layers of the TouchTutor™ support package were utilized for the first time in 2015 with Tablets, laptops and desktops to add more excitement and impact to the techno-blended incubation and support model that was implemented. In semester 1 of 2015, the latest version of the Tablet & TouchTutor™ based model was used successfully with more than 1000 learners with potential in over 70 schools in the province.

The accredited skills development programmes for in-service maths and science teachers also experienced major growth in 2015 as over 600 maths and science educators from more than 8 education districts have registered. The programmes in 2015 are again commissioned by the DBE and offered by the GMMDU in partnership with the Faculty of Education at the NMMU.

An innovation is the integration of interactive language support as part the TouchTutor™ mathematics resource package. A digital look-up and translation functionality embedded as part of the TouchTutor™ package will soon provide comprehensive maths language support (and translations in any one of six African languages) while learners engage with the content and interactive assessment components of all the curriculum-aligned digital material. The latest components will be available as part of a professional version of the TouchTutor™ support package that is currently being developed in partnership with a professional software company for testing in semester 2 of 2015.



"Our South African youth must study maths and science in order for us to be a winning nation"

Dr Govan Mbeki (LLD)

MATHS AND SCIENCE SUPPORT…Old Mutual CEO, Marshall Rapiya (second from left), hands over a cheque to Prof Werner Olivier, Head of the GMMDU and Prof Andrew Leitch, DVC Research and Engagement, NMMU at the launch of the Old Mutual Education Flagship Programme's Maths and Science Development Project. On the far left is Mr Nceba Pupuma, Regional General Manager, Old Mutual

Maths & Science upgrade for 18 Bhisho schools

EIGHTEEN rural high schools in the Bhisho area have received a high-tech Maths and Science boost, with the 2015 launch of the innovative and comprehensive Old Mutual Education Flagship Programme's Maths and Science Development Project (OMEFP). The two-year project, which involves a sponsorship amount of more than R7 million, will be run in close collaboration with the provincial Department of Basic Education. "We are using a 21st century, techno-blended model in an offline format to support previously-disadvantaged schools that face lots of socio-economic challenges," said GMMDU head Prof Werner Olivier, who also holds a FirstRand Foundation Chair in Maths Education.

At the project's heart is an innovative teaching and learning model available via a comprehensive classroom support package called TouchTutor™, which uses video-based Maths and Science content, animated PowerPoint lessons, learner workbooks, self-tests and a range of additional curriculum-aligned digital support material, to get its message across.

Developed and fine-tuned by GMMDU and the FirstRand Chair programme over the past five years, TouchTutor™ is available on laptops for teachers – which can be used as teaching aids in the classroom – and Android tablets for learners, to be used as "personal tutors" after school hours. Desktop models will also be available at each school in the form of a resource centre to ensure more pupils have access to the support programme in Grades 10-12. The science series currently includes more than 80 pre-recorded laboratory experiment videos. OMEFP is a "pilot laboratory" focusing on Grade 10 to 12 FET teacher and learner support in the schools, which are situated in a 20km radius around Bhisho. Promising learners from each school will receive Android tablets loaded with the TouchTutor™ package to support their studies on a 24/7. basis.

Govan Mbeki Mathematics Development Unit
empowering young minds

Continued….

The project will also include Tablet-assisted After-school Peer Support (TAPS) Maths sessions to complement and supplement the regular school programme, providing consolidation and structured revision for examinations.

Olivier said the latest improvements on the TouchTutor™ package were "tablet-based interactive assessment and the logging of user activity on Android devices", which will enable learners to test what they know via lesson-aligned multiple choice tests with immediate feedback. This also helps the researchers to profile the interaction of learners with the support package.

Learners from Nosizwe High School, Bhisho

Learners from Bhisho High receive tablets

GMMDU flagship learner programme

Incubator School Program (ISP)

2015 marks the 10th year of the GMMDU's Incubator School Programme (ISP), our flagship Maths and Science learner support programme.

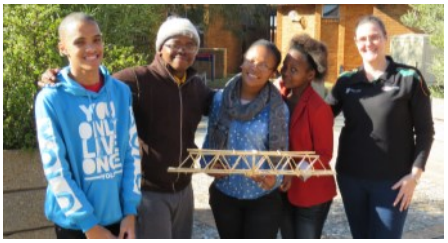
At the launch of PE and Uitenhage programme on 14 February at NMMU's Missionvale campus, an excited group of almost 250 learners from 55 schools in the Nelson Mandela Metro (NMB and Uitenhage), were introduced to the programme and received their Android tablets which they keep until their final exams. An experienced and dedicated team of team of teachers from Metro schools provided co-ordination and facilitation over 14 weeks of content teaching, practice, skills development and assessment in Mathematics and Science, including exam preparation. The programme was concluded with a certification and awards ceremony.

Satellite ISPs have been run at various centres in the Eastern Cape and this year Somerset East and Queenstown have catered for local learners from Grade 10 to Grade 12.

Experienced ISP Coordinators & Facilitators

GMMDU partner with Unity in Africa Foundation

The GMMDU has partnered with the Unity in Africa Foundation to provide opportunities for selected learners to be part of a comprehensive longer term support programme involving additional IT skills, industry links, personal development and GAP year and study support with a view to future employment in the local Engineering and Built Environment sectors. 15 grade 11 ISP learners joined the iGEMS programme for the first time this year.



iGEMS learners Bridge Building activity

TouchTutor™ Maths competition on Mxit

The TouchTutor™ Maths Competition is currently being run for the third consecutive year by the GMMDU in a digital format with entrants using the Mxit system and mobile devices. Round 1 of the competition, completed on 29 July, attracted Grade 9 and 11 participants from more than 60 schools, mostly from the Eastern Cape with a smattering of interest from other provinces.

The digital format, with flexible administration and efficient marking and feedback, has enabled participation from learners in remote parts of the province which is in line with the goal of popularising Mathematics.

The winners of prizes for the best school participation in the first round are Breidbach Senior Secondary School from the King William's Town district and Pearson High School from Port Elizabeth. Each school will receive a R1000 cash prize to be used for the promotion of Maths at the schools.

Selected learners take part in Rounds 2 (26 August) and Round 3 (16 September) after which prize winners will be announced.

All registered participants receive a bonus of free access to the Curriculum Support Application - a comprehensive set of on-line Maths exercises which are designed specifically for the CAPS curriculum and will assist learners in consolidating the skills and preparing for examinations.

TouchTutor™ Maths competition flyer

Resource Development

TouchTutor™ landing pages for Android Tablets

In 2015 the GMMDU is continuing in its strong tradition of developing quality learning resources for both Mathematics and Science at the FET level.

Building on the successful completion of the FET CAPS Mathematics Video Series for Grades 10-12, a team of developers is tackling the Senior Phase curriculum, hoping to round off a complete set of videos, PDFs, tests and applets in the first semester of 2016. This will enable the GMMDU to support projects for Grades 7 to 9 which is an area of critical need.

Another team of Science educators is busy working on the completion of the CAPS version of the FET curriculum for Science which will enhance the popular existing materials in this area and complement the Mathematics package.

In addition to these new learning materials the Unit has developed a management and delivery system for maths and science content. Together with the content, the system is known as the TouchTutor™ system. The current version of the integrated package was developed in collaboration with the NMMU Computer Science Department and has been distributed on close to 1000 Android Tablets in various learner programmes in 2015. Management and reporting in these projects have been greatly enhanced by the ability, for the first time, to upload learner performance and usage data. Interactive testing and mathematics applets have also been introduced for the first time.

As a consolidation and extension of this development, the GMMDU has contracted The Code Group, a local IT development company, to extend and professionalise the system, particularly in the area of data management, visualisation and reporting. This collaboration will also be significant in enabling the preparation of customised packages for the growing number of GMMDU projects and for a diverse range of platforms and curriculum levels. Products are now in the final stages of development and testing and the Unit looks forward to rolling these out in 2016.

Accredited Maths and Science Skills Upgrade for teachers

2015 has witnessed the largest cohort of teachers on the MATHSUP and SSUP programmes to date with 316 Maths teachers and 309 Science teachers on the programmes. Considerable organisational and logistical challenges, inherent in working on a larger scale with the Department of Basic Education in a large geographical area, have been met only by a concerted team effort by the entire Unit and its associates.

As well as engaging with the acknowledged content gap of teachers in these subjects, the Maths and Science professional development programmes introduce a range of technology which is increasingly indispensable in the teaching of Mathematics and Science. This approach involves equipping participating teachers with customised laptops with a wealth of Mathematics and Science learning and assessment material as well as the iconic dynamic graphics software package GeoGebra, which is proving to be an excellent vehicle for professional development, particularly in Mathematics. FET Simulations are included for Science teachers which also provide opportunities for dynamic teaching and learning through modelling and visualisation of physical and chemical processes.

Over the past few years the Unit has accumulated a very substantial base of evaluative responses to the courses by participating teachers from which it is clear that the courses are highly rated and valued as essential opportunities for professional growth and the impetus for developing supportive communities of practice among Maths and Science teachers. This is essential in a context in which teachers can feel isolated and unsupported by official structures. The Unit's approach of close collaboration with the Department of Basic Education in the province has proved to be productive in an area sorely in need of modernisation and forward momentum.

Maths teachers at Trinset College in Mththa (top right); Mathsup in Lusikisiki (middle) and SSUP experiments (bottom)

GMMDU in the news

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Maths unit boosts pupils' X factor

An offline tutoring programme is giving talented but sidelined pupils a fighting chance

Werner Olivier

Democracy may have come of age this year, but an education crisis remains in the majority of South Africa's schools – particularly when it comes to mathematics and science.

In fact, last year's World Economic Forum survey put mathematics and science education in South Africa at the very bottom of the list – 148th out of 148.

So it is nothing short of remarkable when a pupil in a historically disadvantaged school in a rural Eastern Cape district achieves 96% for maths and 92% for science. This is what 18-year-old Mava Qolo did last year, becoming the top-achieving pupil in previously disadvantaged schools in the Cradock district. It is also remarkable that Cradock, out of 84 districts assessed for improvements in mathematics over the past four years, has been recognised as the third-best nationally and second-best for improvement in physical science over the same period.

Four years ago, an innovative, technology-linked offline teaching and learning model for maths and science, developed by the Govan Mbeki Mathematics Development Unit at the Nelson Mandela Metropolitan University, was first introduced in this district.

But before one looks at the model, and without a doubt at the role it has played in Qolo's and Cradock's success, it is important to examine the broader context of education in rural South Africa.

The first factor to take into consideration is the legacy of apartheid, when the government largely ignored schools for black pupils, particularly in rural areas. The second is that, although the post-1994 government has made attempts to put things right, some strategies seem to have had the opposite effect.

Some of the macro strategies by leaders in education, including experimenting with outcomes-based education and the closure of all teacher training colleges, appear to have contributed to the further demise of mathematics and science education.

At the heart of the problem is the fact that there are huge deficits in school management and too few teachers of mathematics and science who meet the minimum standards. Many teachers are unqualified or underqualified, and little is being done to encourage and support them to improve their subject knowledge.

What is more, most teachers are teaching in the same way they have done for decades, using the old "sit, get and forget" model, and making no attempt to tune into the changing needs of today's techno-savvy pupils, who need to become productive digital citizens in a socially connected 21st-century world.

It is the pupils who ultimately suffer. Many drop out of school before getting to matric, and our matric pass rates and standards are low.

Not nearly enough pupils qualify for science, engineering, technology and related courses at universities and colleges, and those who do are often not well equipped enough to cope with the demands of tertiary education.

This is the context that inspired the creation of the Govan Mbeki Mathematics Development Unit in 2002, and that has governed all its programmes ever since.

For the past 13 years, the unit and, for the past five years, the FirstRand Foundation chair in mathematics education, both of which are based at the Nelson Mandela Metropolitan University, have been working on a teaching and learning model that gives pupils in the worst Eastern Cape schools a leg up – a chance at boosting their marks and qualifying for tertiary education.

The maths unit, which won a national Impumelelo Social Innovations Gold award in December 2013, has always focused on urgent short-term solutions to help pupils with potential, such as Qolo, who were caught in a vicious education spiral but who aspired to acquire a post-school qualification.

The model has evolved to the point where the entire curriculum for maths and science in grades 10, 11 and 12 – in the form of video-based lessons, animated PowerPoint presentations, calculators and exam revision videos, experiments, simulations and other visual and high-tech digital resources – is available offline on a tablet for pupils.

It is offline because most of the schools in the unit's target areas have no access to the internet.

But, even where internet connections are available, several serious challenges stand in the way of quality learning. These include a lack of adequate security at schools and a lack of technology support for teachers, who also lack the skills to use web-based material. And, of course, load-shedding is a factor.

The maths unit's offline model, with a tablet that can maintain its charge for several hours, overcomes these challenges.

In parallel, and through each stage of its development, the FirstRand chair has tested the model in 10 Port Elizabeth schools, constantly improving it, based on feedback and its success in practice.

The central support package for the techno-blended model, called TouchTutor, also has interactive self-assessment and feedback, and a Mxit-based maths and science curriculum support system.

How it works is that pupils with potential (picked by the unit, in collaboration with the department of basic education) are introduced to the Android tablets by an incubator school programme run over 14 Saturdays, or an after-school tablet-assisted peer-support programme, run on school days.

In general, pupils who attend the incubator school programme or after-school tablet-assisted peer-support programme, and who receive the tablets, which are for use after school hours as personal tutors, improve their marks by at least 10%.

Qolo, who attended Matthew Goniwe High in Cradock, attended an incubator school programme. He said one of the main problems he experienced throughout his school career was that his teachers lacked sufficient knowledge of the subjects they were teaching. Armed with the tablet, he could fill in the gaps.

In his words, the incubator school programme was "the greatest resource". Already a self-motivated pupil, who used to memorise his textbooks and use Google for extra information, the addition of the incubator school programme and tablet saw his marks going from 60% to 69% in grade 10 and 80% to 100% in Grade 12.

He is now studying mechatronics at the Nelson Mandela Metropolitan University.

His results are even more impressive when seen in the context of the Eastern Cape's poor pass rates for maths and science, which last year were 42% for maths, the second lowest in South Africa, and 51% for science, the country's lowest. National pass rates were 53% for maths and 61% for science.

The maths unit has also developed a university-accredited professional skills development programme for in-service maths and science teachers that uses the offline teaching and learning model, and has become a second central focus of the unit.

TouchTutor is available on laptops for teachers for use as a classroom resource. There is also a desktop model for pupils. The unit and the FirstRand Foundation chair have placed desktop resource centres in more than 100 Eastern Cape schools over the past year.

In April, the unit received a letter from Edgar Klaasen, Cradock's acting district director, informing it of the district's impressive national achievements. It stated that the unit's educator training and incubation school programme had "contributed significantly to our mathematics and physical science grade 12 results over the past four years ... These accolades would most definitely not have come our way without your intervention."

Since 2010, the unit's interventions have reached more than 2 000 selected pupils and more than 700 in-service teachers in the Eastern Cape and further afield. Scores of pupils have emerged from the incubator school programme with improved skills and have successfully progressed within study programmes at higher education institutions over the past five years.

This year, 750 grade 11 and 12 pupils from more than 80 mostly under-resourced Eastern Cape schools are busy completing one or other of the programmes. Qolo's story, Cradock's story, and other similar success stories linked to the development programme, are what the unit and the chair's efforts are all about – to harness the potential of modern off-line technologies in an innovative way to ensure that pupils with potential progress, despite the sometimes overwhelming challenges that exist in schools.

In recent years, the department of education has chosen to work closely with both the unit and the chair to ensure that an accredited and more sustainable professional development programme for in-service mathematics teachers is implemented in the Eastern Cape.

As a result, the unit's reach has been extended to 12 of the 23 districts of the Eastern Cape, and also to the Free State, and it is hoped that this model can be duplicated in other areas to empower as many teachers and pupils as possible.

Add it up: A new tutoring model is succeeding in areas where pupils tend to fare poorly at maths and science. Photo: Cedric Petersen/Maths Centre

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Professor Werner Olivier heads the Govan Mbeki Mathematics Development Unit and also occupies the FirstRand Foundation chair in mathematics education, both at the Nelson Mandela Metropolitan University. He won the university's Engagement award for 2014

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22 Jan 2015, p.10

SKILLS BOOST FOR EC MATHS AND SCIENCE TEACHERS IN THE PROVINCE - GILL COLLEGE,

Science

Maths

Video lesson components of the TouchTutor™ maths and science resource available to NMMU students on student portal

SOMERSET EAST

Mathematics and science teachers from Graaff-Reinet, Cradock, PE, Uitenhage, Grahamstown and East London districts were part of the weeklong programme from 12-17 January. Teachers stayed at Gill Senior Hostel and Bellevue Hostel for the duration of the course. 12 Mathematics teachers and 79 Science teachers attended the course. This was the first course held for science teachers. Some mathematics teachers from the different districts have been involved for the past few years already.

The Grade 11 and 12 teachers and TVET lecturers completed two Short Learning Programmes through the NMMU-accredited Mathematics Skills Upgrade Programme (MATHSUP) and Science Skills Upgrade Programme (SSUP), with funding provided by the Education, Training and Development Practices (ETDP) Seta and the provincial Department of Basic Education (DBE).

The investment in skills upgrade programmes for in-service teachers forms part of a provincial strategy by the DBE to improve the state of mathematics and science education in secondary schools in the province.

"In-service Mathematics and Science educators are in need of regular professional support and development programmes to address a widespread lack of content knowledge and related skills," said GMMDU head Werner Olivier, who also holds a FirstRand Foundation Chair in Mathematics Education.

"The desperate situation in Mathematics and Science education in the Eastern Cape calls for even more aggressive interventions of this type in the future."

At the heart of the MATHSUP and SSUP programmes, which focus on Further Education and Training (FET) content knowledge and teaching skills, is a high-tech, offline, curriculum-aligned teaching and learning model, which gets its message across via user-friendly, video-based content, animated PowerPoint lessons and a range of additional curriculum-aligned digital support material, loaded onto laptops.

The classroom support package, called TouchTutor™, which has been developed by GMMDU over the past five years, is also available on Android tablet as a tool to assist learners. The science series currently includes more than 80 pre-recorded laboratory experiment videos.

As part of the programme implementation, each participating teacher will receive a laptop with the TouchTutor package and additional teaching support material, all pre-installed.

"TouchTutor harnesses popular technology in the teaching of maths and science, to appeal to today's youth – and also encourages an interest in these important subjects, which are needed to sustain and build 21st century technology-based economies," said Olivier.

The use of MXit (for SMS-style learner self-assessment and feedback via mobile phone), video content, simulations and high-tech open-sourced software, such as GeoGebra, ensure that maths and science come alive for teachers and learners.

"The reality is that most teachers lack technological pedagogy knowledge and skills to integrate even the most basic technology in classrooms, including the use of the scientific calculator."

Feedback from the participants, whose marks had improved significantly by the end of the course, was "overwhelming positive", said GMMDU's Pieter Weisswange, who facilitated SSUP. "The educators gained a lot – in conceptual understanding, in knowledge, in confidence and in resources for use in the classroom.

"We now look forward to the classroom implementation of what the educators have gained, hopefully leading to a better understanding and performance by learners."

GMMDU

Saturday School lifts Maths, Science marks

SATURDAY School has started for 450 Grade 11 and 12 learners who have been selected from 60 mostly under-resourced Eastern Cape schools to participate in a technology-linked incubator school programme, geared towards boosting their Maths and Science marks.

The 14-week programme, run this year in Port Elizabeth, Uitenhage, Queenstown and Somerset East by Nelson Mandela Metropolitan University's Govan Mbeki Mathematics Development Unit (GMMDU), boasts an impressive track record, with previous participants achieving top results.

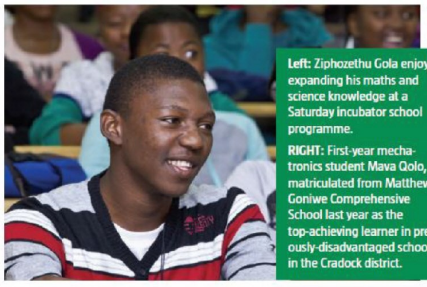
Last year, Muir College matriculant Lyle Ressouw came third in the country for Maths and was ranked third overall in the Eastern Cape, while Mava Qolo, who attained 96% for Maths and 92% for Science last year, was the top-achieving learner in previously-disadvantaged schools in the Cradock district, where he attended Matthew Goniwe Comprehensive School.

Qolo, 18, who is studying towards a BEng (Mechatronics) degree at NMMU, said the incubator school had helped him to "learn quickly" and effectively study the complete Maths and Science syllabi over the course of his matric year. "In Grade 10, my results were not that good. I was achieving level 5. After starting the incubator school, I started getting to higher levels, with my greatest ever results in Grade 12."

It is the 10th year the programme is being run in Port Elizabeth and Uitenhage, the sixth in Somerset East, and the second in Queenstown. Last year, the average percentage for Maths from the matrics in the Port Elizabeth Incubator School was 61% and for Physical Science, 58% – significantly higher than the provincial averages of 42% for Maths and 51% for Science.

GMMDU Head, Prof Werner Olivier, who holds a FirstRand Foundation (FRF) Chair in Mathematics Education at NMMU, said NMMU's FRF Chair programme had contributed significantly to the development of the innovative assistive-technology models being used in the incubator schools and GMMDU's other Maths and Science development projects.

Above: Muir College matriculant Lyle Ressouw, a past participant in the incubator school programme, came third in the country for maths last year.



Left: Ziphozethu Gola enjoys expanding his maths and science knowledge at a Saturday incubator school programme.

RIGHT: First-year mechatronics student Mava Qolo, matriculated from Matthew Goniwe Comprehensive School last year as the top-achieving learner in previously-disadvantaged schools in the Cradock district.