NELSON MANDELA UNIVERSITY

Faculty of Science

We are Nelson Mandela University

We are **Nelson Mandela University**.
We are the only university in the world to be named after Nelson Mandela.
Our iconic South African statesman, humanitarian and leader is known globally for what he achieved.
We are honoured as **Nelson Mandela University** to carry his name.
In return, we honour our namesake by endeavouring to live his legacy.
We honour him by using his name in full.
We are Nelson Mandela University.

Editor: Heather Dugmore | **Design:** Juliana Jangara

Contents

Leading Knowledge, Innovation and Interconnectedness
to Transform Society

FOREWORD

Foreword by the Executive Dean of the Faculty of Science, Professor Christa Grobler

It gives me great pleasure to introduce this annual Faculty of Science publication. As we reflect on the past year, this document serves not merely as a record of achievements, but as a compelling demonstration of our deep commitment to the Nelson Mandela University vision: to be a World-Class, Engaged, Transdisciplinary 21st Century African Faculty of Science.

Our work is fundamentally rooted in the philosophy of Ubuntu—that communal spirit which recognises our interconnectedness—and is focused squarely on the tenet of Science for Society. Every highlight captured within these pages reflects the dedication, creativity, and resilience of our staff and students as we leverage scientific innovation to address South Africa's most pressing socioeconomic and environmental challenges.

Our approach to Learning and Teaching is focused on delivering a 21st-century, Africa-purposed science curriculum that is inclusive and responsive. We recognise that transforming the learning experience requires deliberate efforts toward decolonisation and academic excellence. Highlights captured here demonstrate significant progress toward these goals:

- Academic Excellence and Support: Initiatives such as the Department of Atmospheric and Oceanographic Sciences (DAOS) and the South African Masters of Ocean Sciences (SAMOS), driven by Dr Denise M. Schael, reinforce critical academic excellence and success structures for our students.
- Inclusivity and Transformation: Our commitment to a humanising, student-centric environment is strengthened through the work of Gideon Brunsdon in enhancing multilingual learning, and Professor Zenixole Tshentu's continued leadership in making Africanisation a defining pillar of our curriculum.
- Innovation in Pedagogy: Faculty members are pioneering new ways to broaden participation in science. This includes innovative platforms such as Chasing Challenges led by Dr Shawn Gouws, Forest21 by Professor Joshua Louw, and the recognition of scholarly excellence through the prestigious TAU Fellowship awarded to Dr Buyiswa Hlangothi.

These efforts collectively aim to equip our graduates not just with knowledge, but with the capacity for innovation, which is critical for the 4IR era.

Prof Christa Grobler

Our Research and Innovation achievements continue to position the Faculty of Science as a leading contributor to knowledge creation, locally and globally. Our focus is on generating cutting-edge outputs that directly address the UN Sustainable Development Goals (SDGs) and Africa Agenda 2063. This edition showcases high-impact, transdisciplinary work:

- Environmental Sustainability and Conservation: We are proud to feature impactful conservation efforts, from the crucial Rhino Dehorning project led by Dr Tim Kuiper – which has garnered world attention for its science-driven approach – to important work on Marine Spatial Planning led by Professor Mandy Lombard, and Professor Janine Adams' continued leadership in estuary water quality research.

> Our approach to Learning and Teaching is focused on delivering a 21st-century, Africa-purposed science curriculum that is inclusive and responsive.

- Energy and Health Solutions: Cutting-edge scientific advancements are reflected in core areas necessary for a sustainable future, including the Photovoltaic Research Group led by Roelof Roodt and Professor Ernest van Dyk. Furthermore, our world-class drug manufacturing research spearheaded by Professor Paul Watts, leveraging flow chemistry, holds potential to increase access to affordable essential medicines.
- Global Competitiveness: The pioneering Optical Fibre research led by Dr David Waswa and the remarkable discovery and work surrounding the Nqweba Meteorite by Dr Nicolas Tonnelier reinforce the faculty's growing contributions to advanced technological fields and planetary sciences, showcasing our global standard of excellence.

Our strategic commitment places Engagement and Service on an equal footing with Learning and Teaching, and Research and Innovation. The work reflects our core mission to build stronger, more inclusive, and resilient communities through the direct application of science. This year's highlights illustrate active community mobilisation:

- Youth Development and Outreach: We are actively cultivating the next generation of African scientists through events like the InnoVenton Youth Career Summit coordinated by Dr Melissa Gouws, and National Science Week 2025.
- Accessible Education: The continued expansion of Tangible under Professor Jean Greyling demonstrates our dedication to making computational thinking accessible to all communities.
- Inclusivity and Partnerships: Our team was at the forefront of raising awareness and inclusivity through initiatives like World Down Syndrome Day. Additionally, our engagement in the Resilience and Smart Cities workshop and the Vhembe District Outreach further demonstrates the faculty's dedication to impactful, community-centred science engagement.

I trust you will find this edition compelling and inspiring. The collective work captured here—spanning foundational academic support to high-impact research on endangered species and critical health technologies—is a powerful testament to the faculty's resilience and purpose.

As Executive Dean, I remain committed to advancing a Faculty of Science that not only generates knowledge but also actively uses that knowledge to transform our society and widen opportunities for all. I look forward to continued collaboration as we collectively strive toward an equitable and sustainable future for our country and continent.

> The work reflects our core mission to build stronger, more inclusive, and resilient communities through the direct application of science.

Advocating for Environmental Stewardship through Science Education

By Dr Buyiswa Hlangothi

The topic of environmental stewardship through science education is informed by our Faculty's graduate attribute of developing students who are stewards of the environment. The project centres on developing an integrated module that promotes environmental stewardship as a graduate attribute by enabling students to apply their disciplinary knowledge collaboratively in addressing environmental challenges. It was initiated at the Teaching Advancement at University (TAU) Fellowship, a national programme focused on developing academics who are reflective, socially responsive teachers and leaders of curriculum change. The TAU platform provided support for exploring projects that align with institutional strategy and context. Using humanising pedagogies that honour students' diverse experiences and study disciplines, the project positions students as co-creators of solutions. By positioning ecological stewardship as a core responsibility for all science students from the outset of their journey at Nelson Mandela University, this project directly advances Science for Society by ensuring that scientific learning contributes to sustainable, socially responsive action.

A series of structured discussion points guided early consultations with colleagues and students. These included identifying overlapping teaching materials, exploring how experiential learning is delivered, and engaging colleagues in a discussion of whether all science students should take responsibility for the environment. Key outcomes include developing strategies to introduce environmental themes to first-year students through both foundational awareness and practical application. These strategies include embedding environmental awareness into orientation-week programmes tailored to science disciplines, embedding environmental case studies into foundational modules such as chemistry, botany and geoscience, campus sustainability tours, peer learning by pairing first-year students with senior students involved in environmental research, simulation games, social-media campaigns, and assessment and reflection strategies.

Another pilot programme is currently being implemented within an existing Organic Chemistry module for the Advanced Diploma in Chemistry. This work serves as a testing ground for curriculum-integration methods, allowing real-time assessment of how environmental stewardship concepts can be woven into disciplinary content without disrupting learning outcomes. It offers proof of concept for broader curriculum transformation by providing insights into student engagement, staff adaptation, and practical challenges across diverse science disciplines.

The long-term goal is to encourage collaboration among all science students by creating opportunities for shared learning and collective problem-solving around environmental challenges. While students in disciplines such as chemistry, botany, zoology, geosciences, and agriculture already engage with environmental themes, Computer Science students may not traditionally be meaningfully exposed to this type of content. Their participation, therefore, brings valuable digital and analytical skills that complement the environmental expertise of other disciplines. They may contribute by developing simple environmental apps, creating data-visualisation tools, designing simulations, or supporting digital awareness campaigns. Through this interdisciplinary collaboration, every student plays a meaningful role in advancing environmental stewardship and ethics across the faculty and, ultimately, to society at large.

Dr Buyiswa Hlangothi (second from right) with her TAU 5 group members. Her environmental education individual project extended to integrate with the group work, looking at sustainability through a collaborative and justice-oriented curriculum. From the left: Prof Shalini Dukhan (Wits University), her project was on STEM student career pathways and professional networks; Dr Sakyiwaa Boateng (Walter Sisulu University), tackling science and mathematics anxiety among students in the STEM environment; Prof Tendani Mawela (University of Pretoria) on Postgraduate ICT curriculum through critical reflection; and Dr Tonderai Muchenje (Tshwane University of Technology) exploring Pedagogy of Care in digital environments.

The Evolution of the Department of Atmospheric and Oceanographic Sciences

By Dr Denise M. Schael and Ammaarah Raza

The Department of Atmospheric and Oceanographic Sciences (DAOS) is undergoing a significant period of renewal and growth. Originating in the late 1970s at the University of Port Elizabeth (now Nelson Mandela University), the original Department of Oceanography was one of South Africa's early academic centres in this field. It offered programmes from undergraduate to doctoral level until institutional restructuring and staffing limitations led to its gradual phase-out by 2000, with remaining academic staff incorporated into the Department of GeoSciences.

DAOS PhD student Brishan Kaylan who is also the 2026 programme manager for SAMOS.

In 2019, the Faculty of Science reconstituted the department as DAOS, in alignment with the University's Vision 2020 and Vision 2030 strategies, which emphasise Coastal and Ocean Sciences as a priority area. The department integrates atmospheric science, which includes meteorology, climatology, and atmospheric physics and chemistry, together with oceanographic science, which examines marine systems from physical, chemical, biological, and geological perspectives. DAOS has since operated as a virtual department supported by a distributed supervisory network while planning for long-term academic and infrastructural development.

A major milestone in this process is the South African Master of Ocean Science (SAMOS), a new multidisciplinary Master's programme and DAOS's flagship initiative, which started in 2026. Building on this momentum, plans are underway to introduce an Honours in Oceanography, with programme approval expected in 2026 and accreditation anticipated by 2028, followed by the development of an Honours in Atmospheric Sciences. South Africa urgently needs more highly skilled ocean science professionals to address national priorities related to climate change, ocean health, sustainable fisheries, and the growing blue economy. The establishment of a dedicated physical departmental home is essential for developing a cohesive academic environment with a strong disciplinary identity.

To support this growth, the University has begun refurbishing the first floor of C-block on the Ocean Sciences Campus. The current R1.4 million upgrade will create a modern classroom, improve laboratory facilities, and establish an administrative office to support the arrival, in 2026, of the first SAMOS cohort. This work forms part of a broader R11 million plan to expand the full suite of spaces needed for DAOS and SAMOS. Refurbishing existing structures rather than constructing new buildings aligns with the University's sustainability commitments, and costs considerably less than a new build. Planned improvements include enhanced natural lighting, updated teaching and laboratory spaces, and dedicated offices for visiting lecturers.

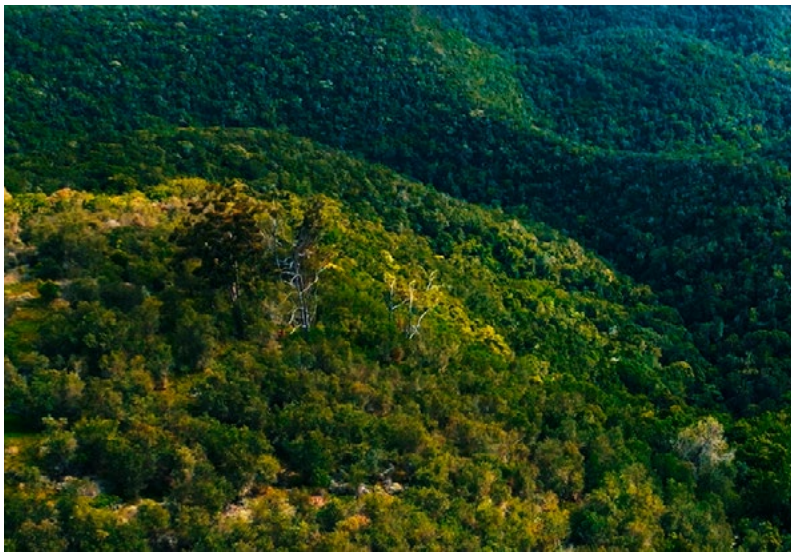
DAOS is also strengthened by its location on the Ocean Sciences Campus, which hosts key national facilities such as the South African Environmental Observation Network and the South African Institute for Aquatic Biodiversity. These partnerships provide students and staff with access to advanced scientific equipment, wet and dry laboratories, research vessels, and a vibrant multidisciplinary research community.

Through expanding academic programmes, strategic national and international partnerships, and ongoing infrastructure development, DAOS is positioning Nelson Mandela University as a national centre of excellence in ocean and atmospheric sciences.

Teaching for Sustainability
– the Forest21 Experience

By Professor Josua Louw and Dr Tatenda Mapeto

The quest for finding solutions to complex socio-ecological problems gave birth to the Forest21 project, titled *"21st Century Climate-Smart Forestry Education for Livelihood and Sustainability in South Africa"*. This innovative four-year project (2021-2024), sponsored by the European Union through the Erasmus+ funding programme, transformed the teaching approach within natural resource management. With support from Norway and Finland partner universities, Forest21 aimed to capacitate educators in South Africa to adopt more progressive pedagogical techniques in the spirit of "problem-based learning" aimed at empowering students with the critical skills of complex problem solving to address socio-ecological challenges, fostering future leaders with the knowledge and skills for creating sustainable solutions. Of particular interest in the South African context are matters related to climate change, water and food security, soil degradation, biodiversity loss, habitat fragmentation and the spread of alien invasive plants, combined with significant disparities in access to resources.



An aerial view of pristine indigenous forests bordering Nelson Mandela University's George Campus. These forests are increasingly valued for the ecosystem services it provides to society, a crucial element of sustainable socio-ecological systems.

The global economy is rapidly changing, adopting elements of sustainability in both technology and the design of business models. Forest21 brought together students from science, marketing and the business environment, ensuring an interesting blend of scientific knowledge and entrepreneurial skills. It is therefore an opportune time to consider options such as certification and ecolabelling, green rewards programmes, payment for ecosystem services, regenerative tourism and environmental offsetting programmes as mechanisms towards a more sustainable global socio-ecological system. This has considerable potential to benefit the biophysical environment, and at the same time create a spectrum of new career opportunities forming part of the green economy.

The profound impact of Forest21 led to a follow-up proposal to the European Union titled *"Multidisciplinary Socio-Ecological Education in South Africa for Sustainability"* – in short "Future21". This three-year project, with a grant value of R16 million, commenced on 1 January 2026, with Nelson Mandela University leading a consortium consisting of Mpumalanga University, Inland Norway University, Hame University of Applied Sciences from Finland, two biosphere reserves (Garden Route and Kruger-to-Canyon) and Forestry South Africa. Dr Tatenda Mapeto will serve as the project manager and Prof Josua Louw as local coordinator on the George Campus. The primary objective of the project is to strengthen the capacity of South African higher education institutions to deliver multidisciplinary, sustainability-focused education that responds to global socio-ecological challenges and the needs of industry and society. It makes provision for the development of future-focused curricula, high impact short learning programmes, professional training, and multi-sector collaborations that support a skilled workforce for sustainable development sectors. These actions aim to empower graduates and professionals with the skills needed to contribute to the sustainable management of natural resources and inclusive socio-ecological well-being.

The strategic value of Future21 significantly supports Nelson Mandela University's vision for leading education in sustainable socio-ecological systems and the green economy. The integration of staff and student expertise across the Faculties of Science and Business and Economic Sciences paves the way for innovations, unique teaching methods, increased graduate employability, and positioning the George Campus and the University as a hub for multidisciplinary sustainability education in Southern Africa.

Multilingualism in the Faculty of Science

By Gideon Brunsdon

Currently there is a big focus being placed on multilingualism in the higher education sector of South Africa, but it seems to fall short when it comes to practice. The Nelson Mandela University Draft Language Policy places a significant focus on the fact that language plays a critical role in improving student learning, access, and academic success. The Draft policy seeks to embed multilingualism institutionally.

The first step in bringing in multilingualism into the higher education sector relies heavily on translation, but translation alone is not enough and on its own cannot decolonise knowledge. To employ multilingualism to its fullest potential requires the production of scholarship in African languages, supported by proper infrastructure, incentives, and assessment systems.

During 17–18 September 2025 Nelson Mandela University co-hosted the Multilingualism Indaba, an event that focused on the vital role of South Africa's diverse languages in higher education. I had the opportunity to deliver a short presentation on the multilingualism strategies that I am introducing in my classroom.

Following the Multilingualism Indaba, contributors gathered at Cape St Francis Resort for a UCDP Language Development Project writing retreat, from 17–21 November, marking progress from policy to practice. During this week the contributors from the indaba had the opportunity to contribute to a monograph which will be published and launched during early 2026.

Various departments and faculties have been experimenting with the implementation of multilingualism in the classroom. Dr Badroen Ismael has developed a translation widget and a chatbot for the Faculty of Education specifically. He graciously allowed me to install and pilot the widget and chatbot into my modules on the Moodle pages (Funda platform) in the Faculty of Science.

By selecting one of the five major languages spoken at Nelson Mandela University – isiXhosa, isiZulu, Sesotho, English and Afrikaans – the entire Moodle page can be translated into the selected language with the click of a button. It is a translation of the headings and general writing that is found on the Moodle page, but it does not translate the uploaded material on the Moodle page.

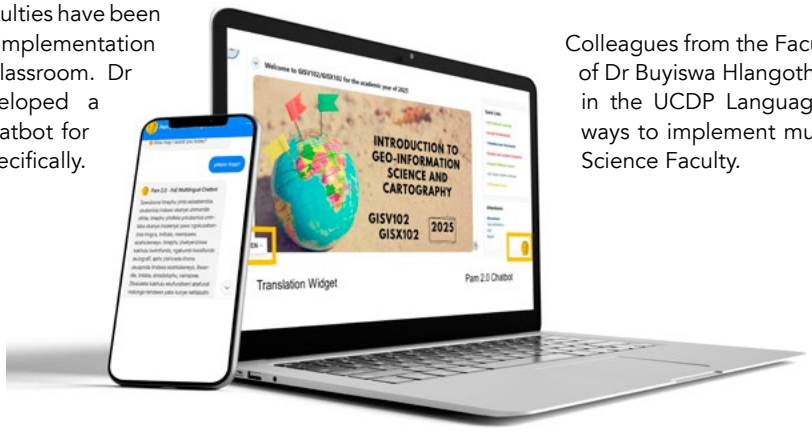
My students in the Faculty of Science can now use the translation widget, and I can begin exploring ways to adapt and further develop it to be purpose-focused for our faculty as I aim to embed multilingualism practices into my classrooms.

I introduced my students to the translation widget with an in-class demonstration during one of our theory lecture sessions. In an end of module feedback session many students indicated that they did not make use of the translation widget. Some students did not know that there was such a widget available, and most students felt that they did not need it.

Similarly with the Pam 2.0 Chatbot, I did a demonstration in the classroom for the students to see how it can be used, otherwise it goes largely unnoticed.

When introducing and employing multilingualism strategies in the classroom we need to be intentional about it and find a way to ensure that students know which resources and applications are available to them.

Colleagues from the Faculty, under the lead of Dr Buyiswa Hlangothi, are also involved in the UCDP Language Plan, looking at ways to implement multilingualism in the Science Faculty.



The translation Widget and Pam 2.0 Chatbot in the Moodle pages.

Co-Creating a Transformative Master of Ocean Sciences

By Dr Denise M. Schael

The South African Master of Ocean Sciences (SAMOS) project is a three-year Erasmus+ capacity-building initiative aimed at transforming ocean sciences education through a collaboratively developed, multidisciplinary Master's programme. Coordinated by the University of Brest (France) with Nelson Mandela University as the South African co-lead, SAMOS brings together nine South African universities (including five historically disadvantaged institutions), five European partners, and the National Research Foundation (NRF). It is fundamentally a Learning and Teaching project focused on strengthening national capacity for the sustainable blue economy.

At its core, SAMOS is co-developing a Master of Ocean Sciences degree that integrates coursework and research within a multi-institutional framework. Joint curriculum design by South African and European academics ensures that global expertise and local priorities shape an innovative and relevant programme aligned with national needs and international standards.

Nelson Mandela University plays a central role as the designated site of delivery. Through the Department of Atmospheric and Oceanographic Sciences (DAOS), it will host the inaugural cohort, beginning with orientation during the week of 2 February 2026. Students will spend their first year at Nelson Mandela University, benefiting from team teaching, shared supervision, and a coordinated academic and industry experience before moving to their research projects with partner institutions. SAMOS also serves as a flagship for DAOS's transition from a virtual to a fully physical department, strengthening its identity and academic capacity.

A key feature of SAMOS is team teaching across institutions. Academics from the South African partners will co-teach modules with European colleagues, enabling shared pedagogical practices, collaborative lesson design, co-assessment, and joint supervision. Twinning arrangements and staff exchanges further support professional development and build lasting academic networks. These approaches enrich student learning while developing sustainable supervision and teaching capacity across the consortium.

Historically disadvantaged universities are integral to SAMOS, ensuring the programme advances equity, transformation, and broader access to high-quality postgraduate education. The project prioritises strengthening supervision capacity, particularly at institutions with emerging research strengths, to build durable teaching and research ecosystems.

SAMOS aligns closely with national higher education priorities. Its strong internationalisation component supports South Africa's goals for global academic engagement, while its focus on expanding ocean sciences capacity responds directly to national development needs. The programme's design adheres to Council on Higher Education quality assurance requirements.

Partnership is the defining strength of SAMOS. The NRF highlights the value of coupling funding with strategic institutional support. Long-standing Franco–South African collaboration in marine sciences underpins the programme, with European partners contributing specialised expertise and South African universities providing contextual insight, transformation imperatives, and commitment to capacity-building.

As SAMOS enters its implementation phase, the consortium continues to advance curriculum development, teaching plans, capacity-building initiatives, and communication strategies. With its co-created curriculum, shared teaching model, and strong national and international partnerships, SAMOS is poised to deliver a high-quality, future-oriented Master's programme that will equip graduates to support South Africa's sustainable blue economy and advance ocean sciences across the region.

SAMOS brings together nine South African universities—five historically disadvantaged institutions—five European partners, and the National Research Foundation (NRF).

Africanisation of the Science Faculty Curriculum

By Debbie du Preez, Lubabalo Saba, Dr Buyiswa Hlangothi and Professor Zeni Tshentu

The Science Faculty's vision is to be a world-class, engaged, and transdisciplinary African Faculty of Science that responds to socio-economic and environmental challenges. This is in line with the University's broader Vision 2030 – to be a dynamic African university, recognised for its leadership in generating cutting-edge knowledge for a sustainable future. As such, one of the key aims of the Science Faculty Curriculum Renewal Project is to respond to the pressing need for the Africanisation of our curricula in service of holistically improving our programmes to provide the best possible education for our students. The workshop on Africanisation of the Science curriculum was held on 30 May 2025 by the Faculty of Science in collaboration with the Engagement & Transformation Portfolio (ETP) Office and the Chair for Critical Studies in Higher Education Transformation (*Cri*SHET). The main aim was to facilitate discussions and develop capacity in the Faculty of Science to build on Africanisation efforts already being undertaken and to pursue new pathways for a science education for Africa. In particular, the workshop focused on how to integrate fundamentals such as multilingualism, localisation of content, Indigenous Knowledge Systems (IKS) and transdisciplinarity, in pursuit of an Africanised curriculum. The DVCs shared perspectives of Africanisation on their own portfolios.

Panellists on multilingualism: From left to right – Dr Shawn Gouws, Mr Luzuko Mbumbulwana (postgrad student in the Faculty of Science), Ms Dipuo Seripe (postgrad student in the Faculty of Science), Dr Jacqui Lück (Faculty of Humanities) and Chanel van der Merwe (Faculty of Humanities).

Africanisation in Higher Education can be seen as the process of integrating African perspectives, values, knowledge systems, and cultural practices into the curriculum, pedagogy, and institutional frameworks. There are infinite ways in which this process can be undertaken. In the Natural and Social Sciences, for example, Indigenous Knowledge Systems are already present in the curriculum and greatly enhance the subject material. In order to create the most valuable and diverse learning experiences it is highly recommended to incorporate aspects of Africanisation into our Science curriculum.

The keynote speaker, Dr Nomalungelo Ngubane, presented a case study of the implementation of Africanisation and multilingualism in the Health Sciences curriculum at the University of the Free State. She put forward a set of principles that, she proposed, should guide the implementation of multilingual and Africanised curricula. These are:

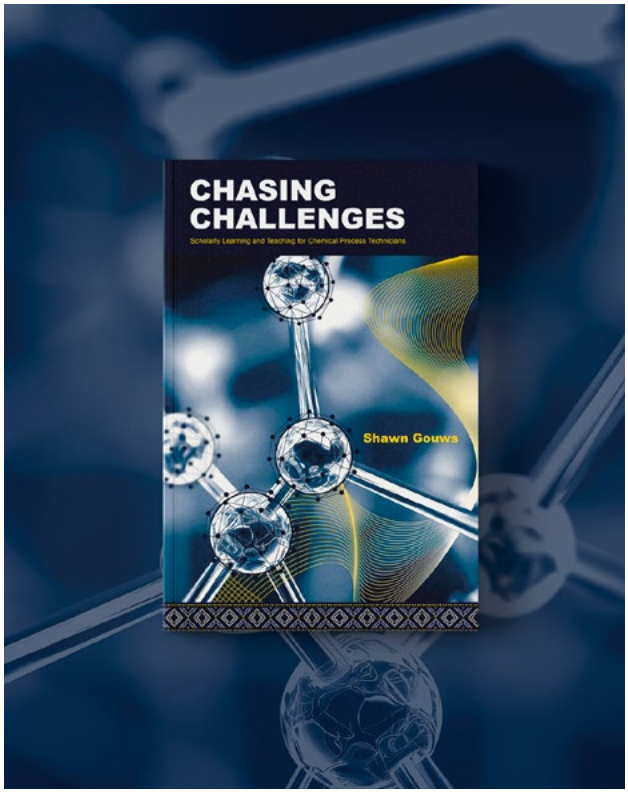
- Epistemic Justice, in order to acknowledge multiple knowledge systems as legitimate.
- Valuing of African languages as carriers of local and indigenous knowledge.
- Inclusivity and access for all students.
- Functional multilingualism to promote actual use (not just symbolic recognition) of African languages in teaching, learning, assessment, and research.
- Cognitive and pedagogical relevance where we use languages students understand best to enhance their conceptual understanding and critical thinking.
- Context-specific flexibility to allow departments to develop responsive strategies, informed by student profiles and disciplinary norms.
- Collaboration and co-construction involving students, staff, and communities in language and curriculum decision-making.
- Resourcing and capacity-building where we invest in terminology development, training of staff, and creation of teaching resources in African languages.

Learning and Teaching for
Chemical Process Technicians

By Dr Shawn Gouws

Chasing Challenges documents an educator's journey through teaching and engaging with students. It records highlights and lessons learnt along the way. It focuses on learning and teaching in chemical process technology, and it records highlights of how a humanising pedagogy is implemented to promote student access and success. This is achieved by unpacking teaching administration elements, such as admission and selection processes, as well as curriculum elements, including teaching large classes, developing technical skills, and promoting effective communication. These serve as examples for other teachers in this field of expertise. A hope is to inspire and encourage colleagues in this and other similar areas of training.

My main philosophy is to create a "sense of wonder" to enable the students to become critical thinkers in solving problems and doing troubleshooting in a chemical production plant. And therefore, it is essential to build relationships with industry and to develop a competency level where the industry can advise on the content and performance of the course through Advisory Board meetings, and to enable students with bursaries and scholarships to study at a tertiary education level.



Book launch attendees with Dr Shawn Gouws. From left – Dr Buyiswa Hlangothi, Dr Noluthando Toni, Dr Muki Moeng, Dr Shawn Gouws, Dr Melissa Gouws and Dr Adeniyi Ogunlaja

Over the years, the industry has placed several Diploma Chemical Process Technology graduates in their manufacturing facilities, and several sectors have invited students to come through their plants and see for the first time how a plant operates. Thanks to donations of pre-used equipment from the industry, it has been possible to build a laboratory facility to show students what actual equipment looks like and how it works.

Blending personal reflection with professional insight, this book explores Dr Gouws' teaching journey and philosophy. This book was written with the focus on student-centred learning and teaching pedagogies. It unpacks the education philosophy and practice of teaching complex chemical concepts in ways that connect students from various diversities to understand the concepts. Utilising simulation-based training to explain various process safety scenarios, what can possibly go wrong in a chemical industry, and, more importantly, how to mitigate before the consequence happens. The book also engages the reader with the realities of language barriers – which is important to overcome in any discipline.

The book was launched on the 24 October 2025 and can be purchased at various outlets, online and in-store at the Mandela Shop and from Mandela University Press.

Science and Technology Centre Hosts Youth Career Summit Exhibition

By Dr Melissa Gouws

Nelson Mandela Bay Science & Technology Centre (NMBSTC) hosted the 2025 Youth Career Summit Exhibition in Kariega (formerly Uitenhage) on 17-18 September 2025. The theme of the summit was "Bridging the skills gap – building the workforce of the future". The summit aimed to bring together learners, youth, TVET colleges and industry to address one of South Africa's most pressing challenges, the skills shortage. The Summit brought together an interactive platform for learners and youth to explore career opportunities, understand industry demands, and gain the skills needed for future employability and entrepreneurship.

Youth and learners who were interested in science and engineering-based careers were encouraged to engage with representatives from industry and academia to consider future career options, such as electrical engineering, mechanical engineering, automotive electronics, logistics, retail, formulation science, catering services and clothing design.

InnoVenton was represented by Dr Melissa Gouws who facilitated a session with learners about opportunities around formulation science and the chemical industry. This was the first time some of them had heard about technological development, what support services are available and what training support can be provided by InnoVenton to SMEs. Technology development is the continuous process of inventing, creating, and improving tools, systems, and methods (technologies) through research and innovation. It follows structured stages, moving ideas from concept to market, and bridging research to industry.

InnoVenton offers a range of workshops to introduce and guide participants through the process of formulating their own products, including cosmetics, creams and lotions. SMEs who are interested in formulating surfactant-based products or using fragrances and essential oils are offered hands-on practical training in the laboratory.

Topics covered in Dr Gouws' session included skills development training, academic pathways, career guidance and careers in the motor industry in the form of interactive discussions and presentations. Several institutions set up interactive exhibition stalls, including the PE TVET, CHIETA, InnoVenton, Volkswagen, Eskom, the Retail Business SETA and Transnet.

Dr Melissa Gouws at InnoVenton's Exhibition Stall at the Career Summit.

The three objectives of the Career Summit were to:

a. Empower learners and youth with practical knowledge and experience to make informed career decisions.
b. Provide a platform for knowledge sharing where learners and youth interact with industry and training institutions.
c. Highlight opportunities in trades, TVET programmes, and other skills development pathways, particularly for Grade 9 learners making critical subject and career choices.

Some local entrepreneurs who started their own businesses in the catering and clothing sectors had exhibitions to inspire learners to use their talent and enthusiasm to create their own opportunities.

National Science Week 2025 – Bringing STEM to the Lusikisiki Community

By Achumile Poni, Lubabalo Saba, Dr Leizel Williams, and Professor Zenixole Tshentu

This year's leg of National Science Week took place in the rural town of Lusikisiki, in the Oliver Reginald (OR) Tambo District, Eastern Cape. The event forms part of the nationwide initiative of the Department of Science and Innovation (DSI), coordinated by the South African Agency for Science and Technology Advancement (SAASTA). The two-day outreach hosted by the Nelson Mandela University Faculty of Science in partnership with the OR Tambo Coastal District Education Office followed the national theme of "Science, Technology and Innovation are for Everyone". The focus was primarily to ensure that science is accessible, interactive, and relevant to young people in the district but also to contribute to improving scientific literacy in an inclusive manner that is shared with the community.

Learners from various schools in the OR Tambo District

The focus of the programme was to ensure that science is accessible, interactive, and relevant to young people, while also contributing meaningfully to the improvement of scientific literacy in an inclusive and community-centred manner. Scientific literacy refers to the ability of individuals to understand basic scientific concepts, think critically about scientific information, and apply scientific knowledge to everyday life, decision-making, and societal issues.

Expert-led lectures and career guidance sessions helped learners understand the relevance of science to their communities, local challenges, and future career opportunities. The programme empowered learners to develop their curiosity, critical thinking skills, and confidence in engaging with scientific knowledge. The range of lectures included a discussion by Portia Tshigoli about the work done by the South African National Space Agency; a talk on animal diseases in the Lusikisiki area – signs, treatments and zoonotic risks – given by Dr Nqobile Jaca-Phakathi (University of KwaZulu-Natal); Okuhle Mbangwa from the South African International Maritime Institute spoke about harnessing marine biodiversity and cultural heritage for a sustainable blue economy in the OR Tambo coastal district; and Dr Buyiswa Hlangothi from Nelson Mandela University discussed Indigenous Knowledge Systems and ways for traditional medicine to reach markets.

More than 2,178 learners from 52 schools attended the event at Lusikisiki College of Education, where they engaged with hands-on STEM exhibitions, live demonstrations, and career guidance sessions led by university departments and national science partners. Exhibitors included Nelson Mandela University divisions across the sciences, SANSA, SAIMI, Sci-Bono, the Technology Innovation Agency, Ingwe TVET College, and several other institutions contributing to STEM education and community development.

The opening ceremony highlighted the importance of collaboration in strengthening science engagement in rural districts. Acting Dean of Science, Professor Zenixole Tshentu, reaffirmed the University's commitment to science in service of society, emphasising that taking STEM activities directly into communities helps bridge gaps in access and opportunity. He also emphasised the need to ensure that no one is left behind as technology advancements are increasing exponentially.

Learners rotated through a wide range of exhibitions covering Physical Sciences, Human Physiology, Chemistry, Agricultural Sciences, Mathematics, and Environmental Sciences, conducting practical experiments and interacting with scientists. Educators noted that the experience supported classroom teaching by helping learners see and understand scientific concepts more clearly.

The Lusikisiki outreach demonstrated the transformative impact of targeted science engagement, strengthening partnerships between our university, schools, and national STEM institutions. By bringing STEM directly to underserved communities, National Science Week 2025 inspired learners, supported teachers, and reinforced the message that science is indeed for everyone.

Scaling Computational Thinking

Across Five Continents

By Achumile Poni and Dr Leizel Williams-Bruinders

The critical global imperative to integrate computational skills into foundational education faces significant hurdles, particularly in resource-constrained educational settings that lack reliable infrastructure. The Tangible initiative provides an innovative, scalable, and academically-rooted solution to this challenge. The project originated from a BSc Honours project at Nelson Mandela University in 2017, where Byron Batteson developed the foundational TANKS coding app.

Tangible's formal structure and global expansion are driven by its founder, Professor Jean Greyling, Head of the Department of Computing Sciences at Nelson Mandela University. Under Prof Greyling's leadership, the project has evolved into a global movement reaching over 350,000 learners, effectively translating university research into massive social impact and digital equity. Tangible is now operating across five continents, launching programmes in diverse settings, from South Korea to the USA.

Unplugged Methodology and Scalability

Tangible utilises physical, hands-on activities that teach essential computational thinking skills, including problem decomposition, pattern recognition, and algorithm creation, without reliance on computer labs, electricity, or the internet.

To ensure rapid dissemination and educator empowerment, the initiative developed an innovative digital solution: an AI-powered WhatsApp chatbot. This tool is key to the project's scalability, distributing free, CAPS-aligned lesson plans for Grades R to 7 to thousands of teachers, directly supporting the future implementation of the gazetted Coding and Robotics curricula in South Africa.

Commitment to Inclusivity and Access

Tangible has engineered specialised coding experiences for visually impaired and autistic learners. This includes the use of 3D-printed challenges, tokens featuring braille, and tactile gridmats – a testament to the project's commitment to providing access for all.

Competitive events

The annual #Coding4Mandela tournament included over 50,000 learners in 2025.

Girls participating in the online Girls Tournament.

The Tangible World Cup featured 340 teams from 30 countries, demonstrating the project's capacity for wide-scale international collaboration, often in partnership with global technology companies.

The data indicates a positive influence on foundational academics, with learners reporting that the programme encourages them to take mathematics, which is a pathway to future STEM careers.

Tangible stands as a definitive case study in how academic innovation can be successfully translated into widespread societal benefit. By focusing on access, awareness, and opportunities for all, the core values of its implementation partner, the Leva Foundation, the project effectively bridges the digital and social divides.

From its origin as a single Honours project, it has become a scientifically robust, scalable platform into the global digital economy, affirming the belief that talent is universal, but opportunity must be created.

Marking 10 Years of Chemistry Partnerships

By Achumile Poni and Professor Percy Hlangothi

Mandela University's Department of Chemistry and the Centre for Rubber Science & Technology celebrated a major milestone during Research Week as they hosted the 10th Collaboration Symposium — a gathering that showcased a decade of partnership, knowledge exchange, and multidisciplinary innovation.

Bringing together researchers from Nelson Mandela University, the University of Limpopo, Walter Sisulu University, UNISA, the University of the Free State, Sefako Makgatho Health Sciences University, and other institutions, the symposium aligned seamlessly with Research Week's purpose: creating a space where scholarship, creativity, and collaboration thrive.

The symposium's keynote speakers set a strong intellectual tone. Political analyst Professor Sipho Seepe and Dr Jeffrey Mabelebele, the new Vice-Chancellor of the University of Limpopo, delivered thought-provoking online presentations that centred on Pan-Africanism, African-led innovation, and the need to draw from the continent's natural resources to define new scientific pathways. Their message encouraged delegates to shift from replicating global models to designing solutions rooted in African contexts.

Showcasing diverse research

Nelson Mandela University's Dr Lungelwa Mahanjana opened the programme with an address exploring the multidisciplinary impact of natural products research. This set the stage for a series of presentations highlighting circular economy solutions, value-added processes, and sustainable technologies.

Key contributions included Professor Linda Linganiso's insights into turning waste streams into valuable products, and Dr Nobathembu Faleni's work on transforming invasive *Lantana camara* into functional materials.

Emerging researchers also featured strongly. MSc candidate Zwivhuya Munyai presented on flame-resistant conveyor belts made from recycled tyre rubber, while Mmabatho Matlaila showcased green nanotechnology derived from banana peels — evidence of the innovative thinking coming from the next generation of scientists.

Reflections and the road ahead

The symposium received highly positive feedback, affirming its value as a catalyst for new ideas and academic networking. Delegates noted the strength of discussions and the spirit of collaboration, while also emphasising that the real impact lies in translating these engagements into tangible projects.

As the conclusion of the event, the Department of Chemistry expressed confidence that the networks built over the past decade — and renewed at this year's symposium — will continue to spark research that addresses pressing societal challenges across Africa.

Keynotes that challenged and inspired: From left to right – Dr Nobathembu Faleni (Walter Sisulu University), Prof Tshwafo Motaung (Sefako Makgatho Health Sciences University) and Dr Mandla Khumalo (Nelson Mandela University).

Attendees on day one of the symposium.

Workshop on **Resilience and Smart Cities**

By Achumile Poni and Professor Zenixole Tshentu

Nelson Mandela University, together with the University of Oldenburg in Germany, hosted a three-day workshop titled "Resilience and Sustainability for Smart Cities and Education" from 24–26 March 2025. The event highlighted a 25-year partnership between the institutions, with participation from academics, researchers, industry representatives, and a delegate from the University of Vechta, Germany.

The long-standing collaboration between Nelson Mandela University and Oldenburg is rooted in interdisciplinary work on renewable energy, climate change, and digital learning. The workshop aimed to reinforce this partnership, identify new project opportunities, and explore innovative solutions to global sustainability challenges.

Professor Zenixole Tshentu, Acting Dean of Science, opened the workshop by emphasising the role of smart cities in improving quality of life, promoting economic growth, and bridging the digital divide. Professor Jorge Marx Gomez stressed that resilience in smart cities must integrate technology with empathy and efficient problem-solving.

The session on Smart Health, led by Professor Brenda Scholtz and PhD candidate Carmen Bekker from Computing Sciences, explored AI-driven healthcare innovation and the need for ethical data governance. Their presentations demonstrated how digital tools — when responsibly managed — can advance well-being and productivity.

Dr Ife Fashoro clarified misconceptions about smart cities, cautioning against high-tech-only approaches that exclude communities lacking resources. She emphasised the importance of smart people", open data, and locally relevant solutions.

A standout project was the uYilo Smart Microgrid, combining solar energy and second-life electric vehicle batteries to reduce operational costs by 38%.

Mental Health, and Resilience

On day two, Professors Ines Oldenburg and Clemens Hillenbrand delivered insights on educational entrepreneurship and strategies to build resilience in learners.

The day also addressed mental health concerns among students from low-income communities and the need for practical, resilience-building activities, especially in schools with limited access to technology.

Back row from the left: Dr Leizel Williams –Bruinders, Lydia Izu, Prof Brenda Scholtz, Prof Ines Oldenburg, Prof Jorge Marx Gomez. Front row from the left: Prof Zenixole Tshentu, Dr Ife Fashoro, Prof Clemens Hillenbrand, Prof Jean Greyling.

Unplugged Coding and Digital Inclusion

Professor Jean Greyling showcased the unplugged Tangible coding programme developed by Computing Sciences as an innovative tool for resilient education systems, particularly in under-resourced environments.

The workshop concluded with the launch of the Tangible Mandela Bay 100 Project at Masifunde Changemaker Academy. Entrepreneur and activist Mkhuseli Jack delivered an inspiring message encouraging digital empowerment and innovation in youth-focused spaces.

A Catalyst for Future Collaboration

The workshop reaffirmed the strength of the Nelson Mandela University–Oldenburg partnership and created new avenues for collaboration in renewable energy, smart technologies, mental health, and digital education. With four successfully completed collaborative projects, Professors Scholtz and Jorge Marx Gomez emphasised that this workshop marks "only the beginning" of future joint initiatives for more resilient, inclusive, and technology-driven societies in the years ahead.

Partnering for **Transformative Vhembe Outreach**

By Achumile Poni, Saba Lubabalo and Professor Zenixole Tshentu

Nelson Mandela University's Faculty of Science, in partnership with the University of Venda (UniVen), completed a highly impactful Vhembe Outreach from 12–16 May 2025 in Vhembe, Limpopo. The annual initiative forms part of Mandela University's Science Engagement Strategy and aims to ignite interest in STEM careers, introduce higher education pathways, and strengthen community engagement in rural, high-performing schools.

A multidisciplinary team from both institutions delivered presentations, demonstrations, and career guidance at five host schools: Silemale, Luvhivhini, Mbilwi, Thengwe, and Mphephu Secondary Schools. Despite initial logistical challenges, the team adapted quickly, using laptops and rotating classrooms to ensure meaningful interaction with every learner.

Delegation members represented: Computing Sciences (Tangible), Engineering and Built Environment, Chemistry, Agricultural Sciences (George Campus), Physics, the Admissions Office, Science Marketing, the Centre for Broadband Communication, and institutional representatives from both universities.

Beyond the host schools, the outreach drew learners from 15 additional secondary schools, expanding the impact to over 2,800 learners from 20 schools in total. Interactive exhibitions, coding workshops, subject demonstrations, and daily presentations about Nelson Mandela University – including a focused introduction to the Faculty of Science – equipped learners with practical insights into study options and application processes.

Cross-institutional collaboration was strengthened through participation from UNISA, the Vuwani Science Resource Centre, PENREACH, and external exhibitors, all contributing to dynamic learning experiences. The delegation also visited the University of Venda campus on the final day to explore further partnerships in science, agriculture, engineering, and rural innovation.

Feedback from learners was overwhelmingly positive, with many sharing their appreciation and interest in pursuing studies at Nelson Mandela University.

Looking ahead, the Faculty of Science aims to expand its rural outreach footprint, deepen collaborations with UniVen, secure additional support for outreach resources, and track learner enrolment influenced by the programme.

The 2025 Vhembe Outreach stands as a strong demonstration of Mandela University's commitment to Science for Society. Through collaboration, passion, and shared purpose, the initiative continues to open doors for young people — one school, one community, and one learner at a time.

Nelson Mandela University and University of Venda delegates ignited interest in STEM careers at 20 high schools in Vhembe, Limpopo.

Advocating for **Inclusive Communities**

By Achumile Poni and Professor Zenixole Tshentu

Nelson Mandela University's Faculties of Science and Health Sciences, in partnership with the South African Agency for Science and Technology Advancement (SAASTA), hosted a World Down Syndrome Day event at the Missionvale Campus under the theme *"Building Inclusive Communities that Advance Support for People with Down Syndrome"*. The gathering brought together academics, parents, clinicians, and community organisations to discuss inclusion, advocacy, and support for individuals with Down Syndrome.

Prof Zenixole Tshentu, Acting Dean of the Faculty of Science, welcomed attendees and acknowledged representatives from SAASTA, the medical sector, community leaders, and NGOs. Although World Down Syndrome Day is officially observed on 21 March, the university selected an alternative date to avoid clashes with Human Rights Day and to ensure full participation.

Prof Tshentu highlighted the role of academia in shaping a society that prioritises dignity and support for individuals with Down Syndrome. He thanked key contributors, including Prof Siyazi Mda (Programme Director), Sharon Masiza (Missionvale Campus Senior Director), Dr Morar Reno (Medical School Director), clinicians from Dora Nginza Hospital, the Biokinetics Unit, and NGOs such as the Port Elizabeth Down Syndrome Association, Early Inspirations, Missionvale Care Centre, Indlela Mental Health, and Ithemba Special Day Care Centre. He also acknowledged the Accessibility and Disability Unit, SAASTA representatives, and organising committee members, including Dolly Ntintili, Achumile Poni, and Sherwin King.

Community-Based Scientific Engagement

SAASTA representative Simon Rametse explained that SAASTA, a division of the NRF, works to bridge scientific research and communities through outreach and educational programmes. He stressed the importance of making scientific knowledge accessible and socially relevant, noting that initiatives such as this event help promote awareness around genetic conditions and foster inclusive, science-informed communities.

Keynote Address by Dr Nomlindo Makubalo

Dr Nomlindo Makubalo, a paediatrician from Dora Nginza Hospital, delivered a powerful keynote address focusing on early intervention, inclusive education, and public awareness.

Dr Nomlindo Makubalo and an attendee during World Down Syndrome Day.

She explained chromosomal differences, emphasising that an extra chromosome does not diminish human worth.

She traced recent advocacy themes, from workplace inclusion to ending stereotypes, and called for improved healthcare support, including early diagnosis, cardiac care, and access to therapies, noting that disability rights are fully protected in the South African Constitution.

Panel Discussion and Community Voices

A panel discussion facilitated by Dr Bruce Damons, offered parents the chance to share lived experiences. Themes included emotional support, healthcare access, and awareness gaps. Parents spoke of the unconditional love, musical talent, and gentle nature often experienced in children with Down Syndrome. The discussion highlighted the need for safer environments, better medical assistance, and stronger community support systems.

Nelson Mandela University's Head of the Department of Human Biology and Integrated Pathology, Dr Tshabalala Zithulele, delivered the vote of thanks on behalf of the Faculty of Health Sciences, noting the collective responsibility to ensure individuals with Down Syndrome live in a society free from discrimination.

Ground-Breaking Drug Manufacturing for South Africa

By Professor Paul Watts and Dr Faith Akwi

Nelson Mandela University is funding a state-of-the-art laboratory that will be used to manufacture pharmaceutical drugs for critical illnesses, including multiple sclerosis, AIDS, TB, malaria, cancer and diabetes.

Construction is underway and it is anticipated the lab will be completed by March 2026. The lab is for the SARChI Chair in Microfluidic Bio/Chemical Processing, which I hold together with my team of twenty postgraduate students and three postdoctoral researchers – one of whom is Dr Faith Akwi, the co-author of this article.

Building pharmaceutical manufacturing capacity at scale is complex but we have committed over twelve years of research into developing the necessary technology and manufacturing capability, using continuous flow technology, to produce the Active Pharmaceutical Ingredients (APIs) – the principal component of drugs.

Continuous flow technology starts with a microreactor about the size of a mobile phone. The scale of production can be increased through parallelisation approaches to produce thousands of tonnes of quality APIs. Another advantage of continuous flow is that the batches are all in specification, whereas with traditional technology one in 10 batches is out.

Manufacturing drugs locally, we can reduce the cost of the drugs by 20% to 30%, and it will give South Africa a far greater degree of independence down the line. South Africa's import of pharmaceutical products is currently over US$2.42 billion (UN Comtrade 2024 database on international trade), with the vast majority of APIs imported from China and India.

In any tablet, whether an aspirin or AIDS medication, about 70% of the cost of the drug is the API. The other 30% is to formulate the APIs into tablets or 'finished drugs'. We are looking to partner with pharmaceutical companies to produce the finished drugs, and there are a number of companies in South Africa that can do this, including Aspen, Adcock Ingram and Cipla.

We will start with teriflunomide for the treatment of multiple sclerosis; which has been shown to slow down the progression of the disease. It is approved by the United States Food & Drug Administration (FDA) and the patent expired in 2023, hence it can be produced locally. Nelson Mandela University's Innovation Office is in the process of submitting the patent to produce this drug to the UK patent office, and we are hoping it will be approved early in 2026. We can then start manufacturing.

From here, we aim to expand our manufacturing to produce known generic drugs for the big five: AIDS, TB, malaria, cancer and diabetes, as well for common illnesses including influenza. We can already produce all these APIs, but we are starting with multiple sclerosis, which is a medium prevalence disease in South Africa.

We would need to produce more or less 100 kilograms of teriflunomide per year for the South African market, whereas for the AIDS drugs we would need to produce thousands of tonnes per year, given that more than 8.5 million people are living with HIV in South Africa. We can certainly get there and the new lab will facilitate this.

As we scale up it will create not only medication for South Africa, but also jobs and contribute to South Africa's research capacity. We can do something really big here. South Africa is always talking about increasing its manufacturing and technological capacity and this is a critical opportunity.

From left: Postdoctoral researcher Dr Faith Akwi, and PhD students Clementine Moreku and Salma Hassan.

PVRG's Role in **Building Better Solar**

By Professor Ernest van Dyk and Roelof Roodt

The Photovoltaic Research Group (PVRG) at Nelson Mandela University conducts cutting-edge applied research that is aligned with the solar energy industry needs, in association with the university's spin-off company, PVinsight (PVi). The PVRG specialises in Photovoltaic module characterisation, with a focus on identifying performance-degrading defects across different types of solar cell and module technologies. The work includes characterisation of PV modules and systems, ranging from small, off-grid installations to large, utility-scale PV power plants. Complementary areas of interest include concentrator photovoltaics (CPV) technology development and data science associated with PV system energy yield and forecasting.

A prominent global issue experienced in the PV industry is the prevalence of glass breakage in glass-glass PV modules. Many instances of this breakage occur during initial installation or within the first few months of operation, reportedly affecting up to 12% of installed capacity. To investigate the root causes of this spontaneous breakage, the PVRG collaborates with Nelson Mandela University's spin-off company, collaborates with PVinsight, Helmholtz Institute Erlangen-Nürnberg for Renewable Energy (HI ERN), Germany, and the CSIR on a Deutsche Forschungsgemeinschaft (DFG) funded project. The group recently hosted a "Glass Cracking in PV Modules" workshop at the CSIR in Pretoria to share knowledge – spanning scientific research, practical testing, and real-world application to address this problem. Speakers at the workshop included experts from Germany, India and South Africa. In addition to addressing the fundamentals of defects in PV modules and glass laminates, the speakers at the workshop highlighted the relevance of this topic and the critical need for international collaboration to solve these defects.

PVinsight (PVi) is an ISO 17025 accredited photovoltaic testing laboratory servicing the Southern African PV industry needs. The collaboration between PVinsight and the PVRG provides the students with a unique opportunity to gain invaluable industry experience as they are exposed to accredited laboratory testing environments and actively participate in projects involving utility-scale PV plants.

The Photovoltaic Research Group 2025

A Decade in Service to Society

for SARChI Chair

By Dr Denise M. Schael

For the past decade, Professor Amanda Lombard has held the NRF South African Research Chair (SARChI) in Marine Spatial Planning (MSP), a role that has significantly shaped ocean governance in South Africa and the Western Indian Ocean. Based within the Faculty of Science and the Institute for Coastal and Marine Research (CMR), her Chair strengthened both the scientific foundations and national relevance of marine spatial planning while enriching CMR's collaborative and interdisciplinary environment.

Since 2016, Prof Lombard has led a comprehensive research programme spanning five themes: mapping and analysing marine biodiversity; evaluating ecosystem services; developing datasets and tools for spatial management; modelling environmental and human-driven change; and applying science directly in MSP processes.

Over the decade, this programme produced more than 90 peer-reviewed papers, influential book chapters, policy-shaping reports, and over 80 conference contributions. Together, this work built the evidence base needed to support sustainable and equitable use of South Africa's ocean space.

A strong commitment to serving society has underpinned the Chair's impact. Prof Lombard's scientific leadership contributed to one of the country's major conservation achievements: the declaration of 20 new Marine Protected Areas in 2019. Her team also led the development of South Africa's first pilot marine spatial plan in Algoa Bay, an innovative process that integrated biophysical data with social, economic, and cultural dimensions, including indigenous knowledge. To further broaden impact and build national capacity, her group launched a Massive Open Online Course on MSP, which continues to support training across the region.

Internationally, Prof Lombard's work has been influential in advancing MSP across the Western Indian Ocean and the Northern Mozambique Channel, where she helped develop spatial planning frameworks for governments and NGOs. She also spearheaded the PHOCIS (Pelagic High seas Ocean eCoregionalisation of the Indian Sub-antarctic) collaboration to design protected area networks for the Southern Indian Ocean, work now informing discussions at CCAMLR (Convention for the Conservation of Antarctic Marine Living Resources), shaping implementation of the High Seas Treaty, and contributing to regional policy processes under the UN Nairobi Convention.

Prof Amanda Lombard

Capacity development has been a defining feature of her tenure. Over the decade, Professor Lombard supervised 10 PhDs, numerous Master's students, and more than a dozen postdoctoral fellows. Many now hold influential positions in government, academia, NGOs, and industry. Remarkably, most publications from the Chair were student-led, reflecting her deep commitment to mentorship and building the next generation of ocean leaders.

Innovation has been woven throughout her programme – from machine-learning-based benthic habitat mapping to system dynamics modelling, elasmobranch reproductive tracking, and deep-sea ecosystem service valuation. These advances continue to influence planning and conservation efforts across multiple ocean basins.

As Professor Lombard transitions into retirement, she will remain involved with CMR and the Department of Atmospheric and Oceanographic Sciences as an active researcher and collaborator. The Chair will move into a new phase as Oceans Ecology and Sustainability, building on the foundations she established to address emerging pressures on marine ecosystems. Her decade of leadership stands as a lasting example of research excellence in service to society.

Nqweba Meteorite Project

By Dr Nicolas Tonnelier

On the morning of Sunday 25 August 2024, a bright fireball and thunderous explosion was witnessed across the southeastern Cape. A meteorite had entered the atmosphere and exploded in the sky, dispersing fragments over a wide area stretching from St Francis Bay to the Southern Karoo. In the small town of Nqweba, nine-year-old Eli-zé du Toit discovered a warm, black-crusted stone falling from a tree in her grandparents' garden shortly after the event. The discovery rapidly grew into a coordinated scientific effort to recover samples, in a collaboration between Nelson Mandela University, Rhodes University, and the University of Witwatersrand. The African Earth Observatory Network (AEON) provided the support needed for the field work. Staff and students from AEON, the Departments of Geosciences and Chemistry led the fieldwork, allowing for the recovery of 15 fragments of the meteorite, between 2 and 7 cm in length (Gibson et al., 2025, S. Afr. J. Sci. 121(3)).

Every meteorite specimen must be registered and characterised in order to be officially recognised by the Meteoritical Society. This consists of a detailed morphological, petrological and geochemical study conducted on representative samples, which was performed in 2025. All specimens selected for this work were first studied at Nelson Mandela University using µCT scans to map internal structures and identify zones of interest before cutting and sample preparation. Some of the sections were analysed with a scanning electron microscope at the Centre for High Resolution Transmission Electron Microscopy (CHRTEM) at Nelson Mandela University. These high-resolution chemical maps of the samples guided further electron microprobe analyses. As a result, on 13 September 2025, the Nqweba meteorite was recognised by the Meteoritical Society (MetBull entry).

Preliminary results showed that Nqweba is a member of the howardite–eucrite–diogenite (HED) group, specifically a brecciated eucrite. HED meteorites are ancient magmatic rocks possibly originating from the crust of 4 Vesta, one of the largest and most evolved asteroids in the Solar System. The observed fall of an HED meteorite and collection of fresh samples directly after the impact is a rare occurrence, with only 62 witnessed and documented events ever recorded. HEDs are important as they provide information on how planets formed during the early history of the solar system. Analyses of the Nqweba fragments revealed a highly complex brecciated texture, composed of various mineral clasts, melt pockets, and deformation features indicative of multiple impact events.

A fragment of the Nqweba HED meteorite recovered during fieldwork by Nelson Mandela University staff and students.

Planned future work focuses on shock features which are microscopic deformation structures formed during high-pressure, high-temperature impact events. These features record the collisions that affected planets during the formation of the Solar System. Using Nelson Mandela University's world-class electron microscopy (SEM, FIB-SEM and TEM), minerals that preserve evidence of these types of deformation will be mapped at high resolution. This work also has the exciting potential for the discovery of rare or previously unknown minerals that can only form under extraterrestrial conditions. In addition the Planetary Science research will contribute to developing a range of educational initiatives to inspire the next generation of young scientists.

Real-time **Fibre-Optic Structural Health Monitoring**

By Dr David Waswa

The Centre for Broadband Communication in conjunction with the Civil Engineering Department has developed and validated a non-destructive, fibreoptic based system for real-time monitoring of compressive strength development in concrete. This work has been presented at the Southern Africa Telecommunication Networks and Applications Conference (SATNAC). Using a MachZehnder interferometer (MZI) with an embedded singlemode optical fibre, the system measures resonance frequency during curing, and maps it to dynamic modulus and compressive strength through established civil engineering relationships. This bridges photonics and concrete mechanics to deliver continuous strength estimation without sacrificial specimens, addressing a long-standing gap in quality assurance for precast and in situ construction. Non-destructive methods allow for the monitoring of real structures continuously without damaging them, giving real-time insight into the properties of the concrete beams. They cut waste and delays from testing and provide data that's more representative of actual in-place conditions.

The research objectives were threefold: to design a fieldable sensing method that tracks early-age strength gain; to establish a robust signal-processing pipeline for extracting the fundamental resonance frequency; and to validate estimates against standard destructive tests. Two 100×100×500 mm concrete beams with different sand-to-grit ratios (60/40 and 40/60) were cast, water-cured at 20–25°C, and instrumented with embedded fibre. The optical setup split a narrow-linewidth laser into sensing and reference arms; the recombined signal, captured by a balanced photodiode and oscilloscope, was normalised and analysed in the frequency domain to recover the primary resonance frequency. Parallel destructive compression tests on 100 mm cubes and a 28-day flexural test (modulus of rupture) validated our results. Results show strong agreement between the non-destructive estimates and destructive measurements.

The scientific contributions include integrating interferometric sensing with civil modulusstrength models for continuous strength tracking; a practical, reproducible signal-processing workflow; and calibration across mix proportions. Practically, the system lays groundwork for structural health monitoring where fibres remain embedded for lifecycle assessment. The work leverages the Centre's optical fibre and signal-processing capabilities alongside concrete testing facilities, showcasing interdisciplinary strength within the Physics Department and Civil Engineering Department.

Concrete cube sample (10x10x10cm) undergoing compression strength test on the compression testing machine.

Future priorities are to broaden calibration across cement classes and curing regimes; scale to reinforced beams; packaging and installation for field deployment; and integrate a data platform for realtime dashboards and alerts.

Overall, this research advances a credible, real-time alternative to traditional strength testing, with clear pathways to impact in construction quality assurance, safety, and efficiency, reinforcing the Faculty's leadership in applied sensing and materials innovation.

Collaborative Research for **Estuary Water Quality Management**

By Professor Janine Adams and Rachel Kibble

Prof Adams holds the Chair in the DSI/NRF Chair in Shallow Water Ecosystems, Department of Botany, and is Deputy Director of the Institute for Coastal and Marine Research (CMR).

Our study titled SOMWAT or 'nature-based SOlutions for Mitigation of WATershed pollution', is a United Nations Decade of Ocean Science project 2021–2030 that investigates the role of seagrass meadows in reducing watershed pollution at the Knysna Estuary. This was a co-developed project with South African National Parks (SANParks) and a partnership with the CMR, the Council for Scientific and Industrial Research (CSIR), the Institute of Marine Sciences (IMS) at the University of Dar es Salaam, and the Helmholtz Institute for Functional Marine Biodiversity at the University of Oldenburg (HIFMB-UOL).

Following field research and collaborative workshops, water quality guidelines were synthesised in a *Proposed Water Quality Management Programme & State of Water Quality* report. Our research highlighted how healthy seagrass habitats form the foundation of resilient ecosystems and thriving coastal communities. The Knysna Estuary is home to the most extensive population of the endangered seagrass *Zostera capensis* in South Africa. This seagrass also forms the habitat for the endangered Knysna seahorse. However, deteriorating water quality threatens biodiversity, recreational activities, and subsistence use. Actions to improve water quality and restore the health of the estuary were identified.

Information exchange and training of stakeholders took place through a 5-day training course on the management of estuaries in South Africa, where the Knysna Estuary was used as a case study. Participants included government officials, national park rangers, postgraduate students and various science institute representatives, and saw over 55 participants and presenters attending. The NGO the Knysna Estuary Research Foundation has been a key member of the research activities establishing opportunities for future collaboration, implementation, and communication of estuary management. SOMWAT made use of SAEON's long-term monitoring data, and important postgraduate studies of Saudiqa Benjamin (MSc), Pierre Bassett (Honours) and Minyonne Verster (MSc) were completed.

We thank MeerWissen and GIZ for funding this study. To stimulate the dialogue and the transfer of knowledge between researchers, managers and policymakers, a video was created to showcase the success of the project.

Endangered seagrass *Zostera capensis* in the Knysna Estuary.

Dehorning Rhinos **Tipping the Balance Against Poaching**

By Dr Tim Kuiper

Black and white rhino populations in the Greater Kruger (Kruger National Park and surrounding reserves) in South Africa have plummeted from over 10,000 rhinos in 2010 to around 2,000 in 2025. Hundreds of rhinos are killed each year by poachers for their horns. These are sold on the illegal global market.

Dr Tim Kuiper from Nelson Mandela University recently led research that points to dehorning rhinos as a key strategy to tackle this poaching threat. The study was published in the prestigious international journal *Science*, in June 2025.

A dehorning operation carried out in the Greater Kruger region. Image: Greater Kruger Environmental Protection Foundation

Nature reserve managers, rangers, international funders, and local non-profit organisations have invested millions of dollars in anti-poaching interventions. These include tracking dogs to track poachers, AI-enabled detection cameras, helicopters to monitor reserves and, more recently, dehorning rhinos.

To see if these interventions were working, the Greater Kruger Environmental Protection Foundation set up a research project involving several reserve managers, rangers, and scientists.

The study documented the poaching of 1,985 rhinos (about 6,5% of the population annually) across 11 Greater Kruger reserves over seven years. This landscape is a critical global stronghold that conserves around 25% of all Africa's rhinos.

The study's headline result was that dehorning rhinos achieved a 78% reduction in poaching (average reduction across implementing reserves). This was based on comparisons between sites with and without dehorning, as well as changes in poaching before and after dehorning.

It is important to note that dehorning is not a complete solution. Our research found that 111 rhinos were poached even though they had been dehorned. This is because up to 15cm of horn is left on the rhino when it is dehorned by veterinarians. This is to protect the growth plate at the base of the horn, as rhino horns regrow over time.

Detecting and arresting is not enough

The nature reserves we studied had invested US$74 million (R1 billion) in anti-poaching interventions between 2017 and 2021. Most of the investment focused on reactive law enforcement – rangers, tracking dogs, helicopters, access controls and detection cameras. This helped achieve over 700 poacher arrests. Yet we found no statistical evidence that these interventions significantly reduced poaching.

These interventions are, however, a necessary element of the anti-poaching toolkit together with dehorning.

What can be done differently?

We recommend these measures:

1. Give local people a voice and a stake. Many people affected by rhino conservation have no say and don't share in the benefits of the industry.
2. Disrupt transnational criminal networks outside protected areas through intelligence-led investigations (follow the money).
3. Continue supporting dehorning and the other anti-poaching interventions. This will buy time to address the drivers of wildlife crime.

NELSON MANDELA
UNIVERSITY

Faculty of Science

CONTACT US

Science Marketing
Department: Science Management

T 041 504 4853
E science.marketing@mandela.ac.za

@Nelson Mandela University Faculty of Science
@science_mandelauniversity
@MandelaScience
@Nelson Mandela Uni Faculty of Science

Executive Secretary to the Dean of Science
Ms Dolly Ntintili
Department: Science Management
Location: South Campus

T 041 504 2873
E dolly.ntintili@mandela.ac.za

Change the World

science.mandela.ac.za

Change the World

Nelson Mandela University
Gqeberha | George

info@mandela.ac.za

mandela.ac.za