



AIMS

African Institute for
Mathematical Sciences
SOUTH AFRICA

Annual Report



2023

About us



The African Institute for Mathematical Sciences (AIMS) is a pan-African network of centres of excellence for postgraduate education, research and public engagement in mathematical sciences. Its mission is to enable Africa's brightest students to flourish as independent thinkers, problem solvers and innovators capable of driving Africa's future scientific, educational and economic self-sufficiency.

AIMS was founded in Cape Town, South Africa, in 2003. Since then AIMS centres have opened in Senegal (2011), Ghana (2012), Cameroon (2013) and Rwanda (2016).

This is the annual report of AIMS South Africa for the period 1 August 2022 to 31 July 2023. It includes an overview of all activities of AIMS South Africa and its associated projects, as well as the financial statements for the 2022 calendar year.

Since AIMS South Africa opened in 2003, 1005 students, of which 35% are women, from 41 different African countries have graduated from its core academic programme.

AIMS South Africa has local association with the Universities of Cape Town (UCT), Stellenbosch (SU) and the Western Cape (UWC) and international association with the Universities of Cambridge, Oxford and Paris-Sud.

AIMS South Africa offers:

- An intensive one-year structured Master's in Mathematical Sciences with intakes in August and January.
- A new Master's stream, AI for Science, was introduced in August 2023.
- Specialised courses as part of regular postgraduate programmes at South African universities.
- A well-established research centre which hosts regular workshops and conferences.
- Professional development programmes for teachers.
- Public engagement activities.

Contents

02 Foreword by Director

04 Academic Programmes

22 Research

35 AIMS Schools Enrichment Centre (AIMSSEC)

40 Public Engagement

49 Governance and Administration

51 Financial Report

Foreword by the Director



Before I joined AIMS, the annual reports were my primary source of information about all-things-AIMS. In the early reports, I found the footprints of the pioneers: the first staff and lecturers and students. The annual reports give a historic account of the evolution of AIMS. They contain the records of who taught what, and from where our lecturers came from. They're also mathematical at heart: the first reports were typeset in LaTeX. AIMS is now entering its third decade, and it is our hope that this report will add to AIMS's rich narrative of growth. As we now enter our third decade, we will celebrate with a festival called *Siyakhula*, named after the isiZulu phrase for "we are growing!"

Just like the Institute, the community of and around AIMS is an evolving one. During 2023 AIMS made 18 new appointments, ranging from new faces in our stellar kitchen team to researchers who joined AIMS full-time, to various part-time appointments. We said goodbye to Dr Barrie Barnard, who steered AIMSSEC for many years, and welcomed Dr Sinobia Kenny to lead AIMSSEC. We will also bid farewell to Dr Simukai Utete, our academic director, at the end of 2023. Everyone at AIMS plays a critical role; the staff form a tightly-knit community and are all mentioned in this report. During the year, AIMS grieved the loss of one of its pillars, Prof. Ronnie Becker, who passed away in March this year.

The commencement speech at our July graduation ceremony was given by Ms Andrea Böhmert, Co-Managing Partner at Knife Capital. She manages a large startup portfolio and venture capital fund, and reminded us of three life lessons that are worth repeating in a foreword. They are as relevant to AIMS and our strategic initiatives as they are for the tech industry:

1. Don't become a prisoner of your own assumptions.
2. If you don't try - you won't get! Take calculated risks.
3. Do as you say and get stuff done!

We are taking calculated risks and are carefully project-planning AIMS's future. We are getting things done. We challenge our own assumptions regularly, so that we can apply our resources in the best possible way to fertilise the mathematical sciences landscape in Africa.

In 2023 we commenced with various planned phases of upgrading and improving our physical infrastructure. The first phase involved renovating 14 Watson Road – a house commonly known by its old signage, "St Claire" – to turn it into a communal house that provides accommodation for approximately twenty students. The next phase involved AIMS's main building and required masterly logistical planning. During July and August all students were sent home, and we had a window of two months to rebuild all the bathrooms from scratch, reconfigure and extend the lecture halls, and add additional teaching space to our main building. The downstairs toilets were demolished and then extended, so that the old 'Biomaths Lab' lecture room could be rebuilt into a larger and more functional format. Our boardroom and small lecture theatre now have interior glass walls, and these are often covered from top to bottom in equations and derivations!



Watson Road renovation.



Main Building renovations

A big change for AIMS South Africa is the start of an AI for Science stream in our Master's programme. AI for Science is supported by Google DeepMind, both financially and through dedicated personal mentoring by researchers in Google DeepMind. It is a tremendous honour that AIMS South Africa is supported by the world's foremost Artificial Intelligence research company. This new stream is capped at 40 students per year, and with a cap of 50 students for our classical Structured Master's programme, we will host 90 taught Master's students per year. This will be a 60% growth in student numbers, and our student accommodation will be completely full!

The AIMS Research Centre is slowly changing gears, and the Machine Learning for Ecology research group, led by Dr Emmanuel Dufourq, has grown to be an epicentre for research at the intersection of artificial intelligence and our natural environment. We've hosted visiting scholars and exchange students and have benefited from a wonderful exchange program with Heidelberg University in Germany.

No year is complete without its challenges. AIMS, having such a pan-African focus, has been hit particularly hard by the delays in visa processing for students from a number of African countries. We have seen numerous students and even visitors from other AIMS centres fall through the cracks of bureaucracy and inefficiency, rendering them completely unable to obtain visas to travel to South Africa. Hopefully, when this annual report is read many years from now, this challenge will be a historical anecdote.

The AIMS culture is unique and is defined by the students, staff, and lecturers from all over the world. It is also defined by our financial supporters, who live by a larger vision for Africa. The culture is lively. Graduation at AIMS is followed by singing and dancing in the street. In this report you'll find reasons for similar jubilation: the stories of many who have built AIMS into what it is today. As we look towards 2024: Siyakhula! We are growing.

Prof. Ulrich Paquet
Director

Academic Programmes

AI for Science Master's Stream

In February 2023, AIMS proudly introduced the AI for Science Master's programme, a groundbreaking initiative that converges artificial intelligence and scientific exploration. This innovative stream has been integrated into our existing Master's in Mathematical Science degree and will be based at AIMS South Africa. Focused on the burgeoning fusion of AI and scientific inquiry, this programme serves as a companion to our African Master's in Machine Intelligence initiative.

Made possible through a generous donation and partnership with DeepMind, the programme will support 40 DeepMind scholars annually for the next four years. DeepMind's contribution encompasses full scholarships, equipment, computation costs, and valuable opportunities for scholars to engage with DeepMind's researchers and engineers, providing mentorship and support.

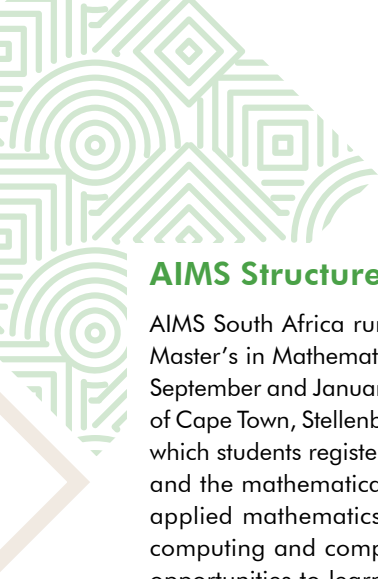
Prof. Ulrich Paquet, programme lead and Director of AIMS South Africa, expressed his optimism: "Through our DeepMind partnership, we aim to engage more African students in pioneering research, enabling them

to contribute to future scientific breakthroughs. The AI for Science Master's programme harnesses the enthusiasm and vigour of the AI community across Africa."

To streamline the application process for the AI for Science stream, AIMS South Africa launched a dedicated applications portal at apply.aims.ac.za. This initiative aimed to assess students' mathematical, problem-solving, and coding abilities consistently. The portal featured a range of questions, from easy to challenging, providing valuable insights into how mathematical challenges are approached across Africa. The gathered data also illuminated specific areas within mathematics and computational sciences that warrant targeted investment throughout the continent.

During the reporting period, candidates for the new AI for Science Master's Stream were meticulously selected, paving the way for their enrollment in September 2023. This marks a significant stride in AIMS South Africa's commitment to advancing cutting-edge research and fostering talent in the field of artificial intelligence and scientific discovery.





AIMS Structured Master's

AIMS South Africa runs an intensive one-year structured Master's in Mathematical Sciences with intakes in August/September and January, in partnership with the Universities of Cape Town, Stellenbosch and the Western Cape, through which students register. The programme is in mathematics and the mathematical sciences. It includes abstract and applied mathematics, statistics and physics, as well as computing and computational elements. Students have opportunities to learn about fundamental mathematics, new applications and cutting-edge science.

The academic programme at AIMS consists of skills courses, review courses and a three-month project. There are also many talks and activities which form part of the students' scientific environment. The 2022-23 intake started in September 2022, with completion in June 2023, and the January 2023 intake started on 29 January.

Skills courses aim to ensure that all students have knowledge of a foundational area, such as statistics, which they will need during their programme. The skills courses during the period included Mathematical Problem Solving, given by Dr Dimbinaina Ralaivaosaona (SU), for the 2022-23 students, and by Prof. Nancy Neudauer (Pacific University), for the 2023 intake. Mathematical Problem Solving is one of the first courses an AIMS student encounters and, like its Physics counterpart, Concepts in Physics and Problem Solving in Physics, given by Prof. David Aschman (Emeritus Professor, UCT) for the 2022-23 group, the course gets students used to the AIMS teaching and learning model, to posing and answering questions and to creative investigation in mathematics and mathematical sciences.

The review courses are electives and offer students a wide selection of subjects. New courses in the schedule included Applying Logic, given by Prof. Jeff Sanders (AIMS South Africa) and Biostatistics, given by Prof. Sophie Dabo-Niang (University of Lille). Dr Riana Roux from SU gave a course on Graph Theory, and students could take Numerical Mathematics given by Prof. Justin Munyakazi (UWC). Prof. Ronnie Becker (UCT and AIMS South Africa), who lectured Financial Mathematics, made an enormous contribution to AIMS and is much missed.

The Mathematics in Industry Study Group took place at AIMS in January 2023, and as usual, students could participate in the Graduate Modelling Camp and Study Group, completing further work, as a course. The further work was in the form of written and oral reports, and these were guided and supervised by Prof. Neville Fowkes (UWA).

Entrepreneurship forms one of the skills courses, the aim being to encourage an entrepreneurial outlook. From February to April 2023, in parallel with their other courses, students from both intakes had entrepreneurial training sessions, aimed at exploring potential business opportunities. The entrepreneurship course led up to a highly anticipated final pitching session on 14 April. In front of judges, industry

experts, and AIMS faculty, seven groups presented their innovative solutions. Farm Connect and Movable Solar emerged as winners, showcasing ideas in agricultural connectivity and solar energy harnessing. These successes highlight the entrepreneurial mindset demonstrated by the students and fostered by the course which inspired students to create meaningful impact. The entrepreneurship course was run by Dr David Attipoe (iiAfrica) and Mr Pius Illah (Machine Intelligence Institute of Africa).



The Graduation and Recognition of Achievement Ceremony for 2022-23 students took place at the end of June. With building renovations scheduled for August, the 2023 students had classes until July, followed by an August break during renovations, and will complete their programme in December.

Combined Courses Table

Period	Lecturer	Course	MSc 2022-23	MSc Jan 2023	Hon. Biomaths 2023
2022					
26 Sept - 2 Dec	Jan Groenewald, AIMS South Africa	Introduction to Computing and Latex Introduces students to AIMS computing facilities and packages, encompassing LaTeX learning via texmaker and engagement with LaTeX Wikibook content and related resources like the American Mathematical Society materials.	x		
26 Sept - 14 Oct	Nathalie Wandji, AIMS Cameroon & Paul Taylor, National Institutes of Health	Python programming Familiarises students with foundational programming concepts and their ties to mathematical sciences using Python, covering data manipulation, loops, best practices, visualisation, and file operations.	x		
	Dimbinaina Ralaivaosoa, Stellenbosch	Mathematical Problem Solving The course considers challenging problems across pure mathematics branches, promoting discussions, varied problem-solving approaches, and research methods to equip students with problem-solving skills.	x		
17 Oct - 4 Nov	Siaka Longue, Institut de Recherche en Science de la Santé	Statistics Focuses on applying statistics in public health, covering experimental designs, data analysis, and impact evaluation using R software.	x		
	Yae Gaba, African Centre for Advanced Studies	Experimental Mathematics with Sage Employs SAGE computer algebra system for experimental maths problem-solving, spanning algebra, combinatorics, number theory, calculus, and Discrete Maths topics.	x		
14 Nov - 2 Dec	David Aschman, Cape Town	Concepts and Problem Solving in Physics Emphasises physics as mathematically describing reality, utilising problem-solving techniques like perspective shifts, estimation, and numerical approaches, with examples from various physics fields, and involving active student engagement in reading, discussions, presentations, computation, and tutorials.	x		
	Bernardo Rodrigues, Pretoria & Simon Mukwembi, Witwatersrand	Algebraic Methods Offers an abstract algebra foundation through two components: Linear Algebra (covering linear spaces, functionals, matrices, eigenvalues, eigenvectors, and graph theory introduction) and Abstract Algebra (including concepts like functions, relations, groups, morphisms, quotients, and Isomorphism Theorems).	x		
	David Holgate Western Cape, Cerene Rathilal, Johannesburg & and Simo Mihethwa, KwaZulu-Natal	Computational Topology Covers topology's continuous deformation concepts, from foundational sets and metric spaces to advanced topological spaces, including digital and lattice-based aspects. The course was followed by a "Topology for Tomorrow" workshop at AIMS, at which students could participate in sessions including attending a panel discussion on topological data analysis.	x		
5-23 Dec	Jeff Sanders, AIMS South Africa	Applying logic Mathematics aids numerical reasoning via calculus, equations, and statistics. This course readies students for related careers, introducing Mathematical Logic's role in discrete systems. Covering propositions, predicate, and modal logic, it emphasises implication and offers case studies for each technique. Concluding with machine learning and security examples, it imparts discrete system skills.	x		
	Tevian Dray & Corinne Manogue, Oregon State	Lie groups and Lie Algebra Lie groups extend continuous symmetries like rotation groups, while Lie algebras represent their infinitesimal counterparts. This course introduces this theory through matrix groups, blending algebra and geometry, emphasising properties of orthogonal and unitary groups to illustrate concepts from differential geometry and abstract algebra.	x		
2023					
9 - 20 Jan	Graduate Modelling Camp and Study Group	Mathematics in Industry Study Group This is a five-day workshop at which academic researchers and graduate students work collaboratively with representatives from industry on research problems submitted by local industry.	x		

9 -27 Jan	Steven Bradlow, Illinois at Urbana- Champaign	Mathematics and Art in Africa Mathematics describes distinctive order in African decorative arts, while these arts also employ a range of mathematical principles; this course examines this synergy using examples like Islamic tiling, Ndebele decorations, Mozambican basketry, and Chokwe drawings, covering symmetry, graph theory, Euler cycles, and number theory.	x		
	Richard Katz, Oxford	Fluid Dynamics Explores fluid dynamics in contexts like air, oceans, and industrial fluids, translating physical problems mathematically. Beginning with viscous fluid understanding, it advances to multidimensional flows, pressure gradients, and momentum-mass conservation coupling. Simple experiments boost mathematical understanding. Prerequisites are fluency in differential equations and vector calculus, and no prior fluid dynamics knowledge is needed.	x		
	Dugald MacPherson, Leeds	Model Theory and Homogeneous Structures Mathematical Logic spans maths, philosophy, and computer science, tackling rigorous foundations, infinity, computability, and reasoning. Model Theory studies structures in logical languages, with broad applications. This course introduces model theory, covering sets, functions, sizes, equivalence, orders, and graphs. It discusses definable sets, compactness, and applications, along with homogeneous structures and the "random graph."	x		
27 Jan	Jan Groenewald, AIMS South Africa	Introduction to Computing and Latex		x	
30 Jan - 17 Feb	Riana Roux, Stellenbosch	Graph Theory This course covers graph theory, discussing topics like graph colouring, domination, and Ramsey theory, which find applications in facility location and scheduling problems. Students will gain the ability to understand graph parameters, apply definitions, construct proofs, and identify real-world problem-solving opportunities.	x	x	
	Claire David, York	Machine Learning for Particle Physics Introduces students to machine learning, from foundational maths to advanced techniques in particle physics applications, without prior physics knowledge. Covering linear regression, gradient descent, and regularisation, it progresses to boosted decision trees, neural networks, and unsupervised methods like clustering. Real-world particle physics examples are highlighted. Students learn evaluation, hyperparameter optimisation, and implement cutting-edge techniques like variational autoencoders. The course culminates in real-life ML projects where students deploy, train, and assess implementations.	x	x	
	Ronnie Becker, AIMS South Africa & Hans- Georg Zimmerman, Fraunhofer	Financial Mathematics This course introduces financial mathematics, covering portfolio theory, risk management, asset pricing, stochastic calculus, and Monte Carlo methods. It employs Python for numerical calculations on real financial data from the internet.	x	x	
	Martha Kamkuemah, AIMS South Africa & Andriamihaja Ramanantoanina, Pretoria	Programming with Python This course guides students through Python programming, covering basics to advanced concepts using Design Space. Topics include Python syntax, data types, loops, functions, and advanced topics like recursion and data structures. Students also learn Python libraries for scientific computing and data visualisation. Design Space will leverage students' mathematical knowledge in order to capture programme requirements before downcoding in Python.		x	
27 Feb - 17 Mar	Lyndsay Kerr, Edinburgh	Analytical Techniques in Mathematical Biology Applies mathematics to real biological issues, focusing on mathematical models for biological systems. It addresses long-term outcomes, parameter impacts, species coexistence, tumour cell growth, disease spread, immunisation effects, and animal coat patterns. Infection models estimate factors like infection rates using real data. The course aims to connect mathematics and biology for practical insights.	x	x	x
	Mike Giles, Oxford	Parallel Computing on CPUs and GPUs This course covers essential parallel computing techniques for modern scientific tasks, introducing hardware concepts and focusing on OpenMP for multicore CPUs and CUDA for GPUs. It emphasises practical implementation with Monte Carlo simulation and PDE solving examples, catering to participants with some C programming experience.	x	x	

Period	Lecturer	Course	MSc 2022-23	MSc Jan 2023	Hons Bio-maths 2023
	Marco Merkli, Memorial University of Newfoundland	Mathematical tools for Quantum Theory Quantum theory relies on functional analysis, a crucial mathematical field, with this course focusing on their constructive interplay. It motivates maths through physical interpretation and vice versa, clarifying quantum concepts. The course covers fundamental concepts in functional analysis, particularly Hilbert space and operator theory, applied in various quantum science branches. Self-contained and requiring only basic linear algebra, it spans quantum physics, information, chemistry, materials science, and biology. Course topics encompass quantum theory postulates, completely positive maps, Markovian semigroups, and master equations.	x	x	
	Eric Andiraintiana, Rhodes	Experimental mathematics with Sage This course introduces an approach to doing mathematics that is founded on experiment and inquiry. It does so in the medium of Sage, a Python-based tool for computation and experiment. Some of the problems studied come from Number Theory and some from Graph Theory. Skill with Sage will be important for many subsequent courses.		x	
27 Feb - 17 Mar	David Attipoe, iiAfrica & Pius Illah, Machine Intelligence Institute of Africa	Entrepreneurship skills and cases This course introduces students to entrepreneurship, business idea origination, and sustainable business model creation using Business Model Canvas, fostering career path considerations.	x	x	
20 Mar - 7 Apr	Phil Knight, Strathclyde	Networks Explores network theory, analysing various real-life networks like family, transport, and banking systems. Emphasising the matrix algebra-graph theory connection, it employs Python for practical analysis, revealing hidden structures and key members in large-scale data.	x	x	
	Matt Macauley, Clemson	Algebraic Biology Mathematical biology has changed using discrete maths and computational algebra, shifting from traditional differential equations to finite dynamical systems like Boolean networks. This course introduces "algebraic mathematical biology," exploring how multivariable polynomials and computational algebra address systems biology problems.	x	x	x
	Patrick Dorey, Durham	Solitons Solitons, identified in 1834, are persistent solutions to nonlinear partial differential equations with intriguing properties and broad applications in mathematics and physics. This course delves into soliton theory, including practical demonstrations, dispersion, waves, numerical simulations, Lagrangian mechanics, topological lumps, conservation laws, and exact solutions using Backlund transformations.	x	x	
	Nancy Neudauer, Pacific	Mathematical Problem Solving Explores challenging elementary problems across various branches of pure mathematics, fostering discussions on investigations, solution methods, and generalisations. It aims to teach students diverse problem-solving approaches and research techniques through practical examples.		x	
17 Apr - 5 May	Stéphane Ouvry, Paris Saclay	Introduction to Random Systems, Information Theory and Related Topics Introduces random systems, probability theory, and Shannon information theory with a mathematical emphasis. Topics include probability calculus, central limit theorem, random walks, Brownian curves, random numbers, Monte Carlo sampling, Shannon entropy, LZW compression, Diaconis riffle shuffle, and random permutations applied to sailing boat regattas.		x	
	Theresa Gebert, Carnegie Mellon	Statistics with Applications in Data Science and Machine Learning Equips students to comprehend and apply statistics and machine learning techniques to real-world data. Covering estimation, hypothesis testing, regression, causality, interpretability, clustering, and anomaly detection, it enables building and training machine learning models using Python's numpy and scikit-learn. Case studies from diverse fields will be explored, and advanced projects could involve natural language processing, reinforcement learning, and deep learning. No prior background is required.		x	

15 May - 2 June	Masood Khaliq, North-West	Symmetry analysis of Differential Equations Introduces symmetry methods for solving differential equations, developed by Sophus Lie, offering a unified approach and powerful techniques for analytical solutions. Covering Lie groups' applications in various mathematical areas and their relevance in physics and engineering, the course focuses on finding Lie point symmetries in ordinary differential equations to derive exact solutions.		x	
	Juerg Weber, Western Australia	Risk Management and Insurance Economics Introduces insurance market operations and contract design, benefiting mathematicians pursuing actuarial and insurance careers. Incorporating financial mathematics and calculus, it follows the textbook "Insurance Economics" by P. Zweifel and R. Eisen.		x	
5 - 23 June	Naina Ralaivaosaona, Stellenbosch & Valisoa Razanajatovo, AIMS South Africa	Probabilistic Method		x	
	Jan Hazla, German Research Chair, AIMS Rwanda	Analysis of Boolean Functions Boolean functions, essential in computer science, map $\{0,1\}^n$ to $\{0,1\}$, serving as the foundation for tasks such as image and text recognition, representing voting rules for analyzing voting problems, and expressing computational challenges on networks. This course explores techniques to analyse their structure and delves into practical applications.		x	
3 - 21 July	Montaz Ali, Witwatersrand	Optimisation In this course, students explore practical discrete optimization problems, including shortest path, max-flow, minimum cost flow, assignment, spanning tree, knapsack, travelling salesman, facility location, vehicle routing, set covering, winner determination, vertex cover, graph partitioning, max-cut, and graph colouring problems. The course examines mathematical and graph theoretical models and studies various algorithms like genetic algorithms, simulated annealing, heuristics, tabu search, and branch and bound. Additionally, it covers very large scale optimization in compressive sensing, maximum clique, quasi-clique, and planed clique, and introduces game theory and Nash Equilibrium.		x	
	Sophie Dabo, Lille	Biostatistics Provides practical skills in health statistics, covering multidimensional data exploration, categorical data analysis, survival models, and high-dimensional regression using tools like R or Python. Students will learn to describe health issue frequency, select suitable analysis methods, interpret results, and construct health scores. Topics include dimension reduction, epidemiology, survival data analysis, categorical data regression, high-dimensional biomedical data analysis, and health score creation. Prerequisites: Basic probability understanding and familiarity with distributions like Binomial, Normal, Student, Chi-squared, Fisher.		x	

“I had the privilege of teaching an Applied Statistics course at AIMS South Africa, an institution renowned for nurturing some of the brightest minds on the continent. The core purpose of teaching at AIMS is to empower these promising students with essential skills and knowledge that will enable them to tackle real-world challenges and contribute to the growth and development of Africa. As an educator, I am constantly inspired by the passion and commitment of my colleagues who, like myself, love the opportunity to share our expertise and witness the transformative impact of education. The students in the Master's programme at AIMS exhibit a strong sense of curiosity and intellectual rigour, making the teaching experience exceptionally rewarding.”

Theresa Gebert, Carnegie Mellon



Research Projects

As usual, supervisors proposed varied and interesting topics for students. Amongst the 2022-23 projects were studies on topological data analysis, on the Poincaré Conjecture and on portfolio optimisation.

The 2023 students selected research projects in July, and will submit in November, with examinations following from the end of November to early December. Project topics were varied, but showed a marked interest in financial mathematics and machine learning.

The 2022 projects included three on symmetry analysis of differential equations. A course on this topic had been given by Prof. Masood Khalique (North West University) as one of the 2022 electives. The 2022 electives also included a course on Statistical Modelling, given by Prof. Timothy O'Brien (Loyola). A number of students selected statistics projects. Other research project topic areas included shallow water equations, bioacoustics, option pricing and complex networks.

Research Projects for the 2022 and 2022-23 Intakes

Full name	Gender	Origin	Research Project Title	Supervisor
January 2022 Intake				
Madoda Kenny Dendeng	M	South Africa	Symmetry analysis for the generalised Oskolkov equation	C M Khalique, North-West
Ganinshuti Pierre Damien Kabyare	M	Rwanda	Statistical Mechanics for Bosons and Fermions	I Mandal, The Henryk Niewodniczański Institute of Nuclear Physics
Bralyne Vanessa Kamga Matoukam	F	Cameroon	Riemann Problem For 1-Dimensional Shallow Water Equations	M Banda, Pretoria
Surprice Makgafela Koto	M	South Africa	A study of certain Lane-Emden-Fowler type equations	C M Khalique, North-West
Fortune Pitsi Lekgwara	F	South Africa	Spatial modelling of housing prices with partially linear spatial regression models	S Dabo, Lille
Tshepo Mahura	M	South Africa	Motif Adjacency Matrices (MAMs) and Application	P Knight, Strathclyde
Dimakatso Makgoba	F	South Africa	Learning from the unseen: Waiting time estimation	D Nickelsen, AIMS South Africa
Phemelo Pabalelo Morao	M	South Africa	Lie group analysis of the modified Korteweg-de Vries equation	C M Khalique, North-West
Denzel Spencer Ngwenya	M	Zimbabwe	Learning to Listen: Unsupervised Audio Classification.	L Jeantet & E Dufourq , AIMS South Africa & Stellenbosch
Kutlwano Othomile	M	Botswana	Optimal stopping and pricing the American option	I Takaidza, North-West
Nombali Qodi	F	South Africa	Predicting Steel Plates Faults using Machine Learning Algorithms	F K Mutombo, Lubumbashi & R Gavhi-Molefe, AIMS South Africa
Enala Sakala	F	Zambia	Spatially survival modelling for cancer data	S Dabo, Lille
Percy Tshikororo	M	South Africa	Optimization of the Call Centre Problem	M Ali, Witwatersrand
Prince Ndivhuwo Tshivhasa	M	South Africa	Likelihood, Score, and Wald Confidence Intervals for Normal Linear and Nonlinear Models	T E O'Brien, Loyola University Chicago
Khanyiswa Tyabule	F	South Africa	Relative Potency and Proportional Odds: Model and Optimal Design Strategies	T E O'Brien, Loyola University Chicago
2022-2023 Intake				
Amna Abdelrahim Osman Ahmed	F	Sudan	The Effect of Material Defects on the Magnetic State of Graphene Sheet: Ab-initio Modeling	E M E Ahmed & M Maaza, iThemba LABS
Elivin Nyanchama Akama	F	Kenya	A comparative study of analytical and computational methods of cumulative risk calculation	R M Łochowski, Warsaw School of Economics & I Mbonda, AIMS South Africa
Sharon Chepkemoi Maritim	F	Kenya	Stochastic models of interest rates: A comparative study of Vasicek's and the Cox-Ingersoll-Ross models applied to the recent ECB data.	R M Łochowski, Warsaw School of Economics & I Mbonda, AIMS South Africa & Stellenbosch

Mohamed Hussien Abdelhameed Elfadul	M	Sudan	On the Iterative Methods for Large Systems of Linear Equations	M Ali, Witwatersrand
Abubakar Mastour Adam Fadul	M	Sudan	Anomaly Detection based on Isolation Forest and Local Outlier Factor	B Bassett, AIMS South Africa & Cape Town
Sarah Gakii	F	Kenya	Modeling the Impact of Human Behaviour on COVID-19 Vaccine Uptake	J Wairimu Kagunda, Nairobi
William Kalukango	M	Zambia	Matchings in Subcubic Graphs	Z B Shozi, Sol Plaatje & E O D Andriantiana, Rhodes
Wisdom Patrick Kapinga	M	Malawi	Population-based Optimisation Algorithms for Tuning XGBoost Hyper-parameters for Covid-19 Diagnosis	C Nyirenda, Western Cape
Mary Wambui Kiarie	F	Kenya	Longitudinal Data Analysis and Trajectory Analysis with Applications	T E O'Brien, Loyola
Victoria Ndunge Kioko	F	Kenya	Portfolio Problem in Insurance	I Takaidza, North-West
Elmar Constant Lasa	M	Madagascar	The Poincaré Conjecture across dimensions	J W Sanders, AIMS South Africa
Khumbulani Similo Lukhele	M	Eswatini	Dark Interactions	A Abebe, North-West
Nonofu Madigele	M	Botswana	Logit modelling of default data	G van Vuuren, Witwatersrand
Wandile Thokozani Manyatsi	M	Eswatini	The Mathematics of Gravitational Waves	C Stevens, Canterbury
Casimiro Alfredo Mavanga	M	Mozambique	Solvability of Linear System of Differential Equations with Non-Diagonalizable Coefficient Matrix	J Banasiak, Pretoria
Helarie Rose Medie Fah	F	Cameroon	Solving Optimization Problems by the means of Quantum Computers	T Konrad, KwaZulu-Natal
Lesego Mokgabudi	M	South Africa	Exploring different asset allocation techniques	G van Vuuren, Witwatersrand
Kelie Marline Momo Nizegha	F	Cameroon	Persistent Homology: Theory and Applications	M V Visaya, Johannesburg & C Rathilal, KwaZulu-Natal
Jenipher Mutale	F	Zambia	Lead-lag and Volatility Point Change Estimations for Cryptocurrencies	J Mba, Johannesburg
John Kivala Mutunga	M	Kenya	Reconfiguration Problems in Domination	R Roux, Stellenbosch
Ann Lilian Wangui Mwangi	F	Kenya	Process Fault Detection using Singular Spectrum Analysis and Functional Principal Component Analysis.	S Krishnannair, Zululand
Marjory Mwanza	F	Zambia	On the structure of finite groups that satisfy the converse to Lagrange's Theorem	B Rodrigues & S Madanha, Pretoria
Enock Ndunda	M	Zambia	Fault Detection of Process Signals using Singular Spectrum Analysis and Neural Component Analysis	S Krishnannair, Zululand
Just Fontaine Nguimatio Dongmo	M	Cameroon	Image Segmentation Model Based on Recurrent Neural Network Reformulation of Level Set	J R Tapamo, Kwazulu-Natal
Musa Njie	M	Gambia	The Equitable Colouring Conjecture	R Roux, Stellenbosch
Moses Katenje Phiri	M	Malawi	Bayesian Optimisation in a Big Data Scenario	S Tilahun, Addis Ababa Science and Technology University
Andriniaina Kevinn Adolha Rajaona	M	Madagascar	Content Generation using Adversarial Reinforcement Learning	J Shock, Cape Town
Fanomezantsoa Fabrice Razafimahatratra	M	Madagascar	Separation Axioms in Locales	C Rathilal, Kwazulu Natal & D Holgate, Western Cape
Blen Belete Shebeshe	F	Ethiopia	A Reinforcement Learning Approach in Combinatorics	C Agyingi, South Africa & Y Gaba, Quantum Leap Africa
Happy Siame	M	Zambia	Average Distance and Leaf Number with Applications to Drug Design	S Mukwembi, Witwatersrand & A Alochukwu, Johannesburg
Beatrice Similindi	F	Zambia	Linear Polarization Measurements with Clover Detectors and Sources	S N T Majola, Johannesburg & E A Lawrie, iThemba LABS
Eleni Asmare Tarekegn	F	Ethiopia	A Survey on the Domination Number of the Zero-Divisor Graphs of (Some) Commutative Rings	E Mehdi-Nezhad, Western Cape
Khadija Mohammed Musa Windo	F	Sudan	Photon Conversion Mechanism for Photovoltaic Application	M Yagoub & E Coetsee, Free State

Tutors

Tutors as always are central to the delivery of the AIMS programme. Several tutors contributed at different times to the programme during the reporting period, including Gaël-Pacôme Nguimeya Tematio (head tutor), Riham Ahmed, Faratiana Brice Razakarino, Musa Hussein, Mafoya Landry Dassoundo, Tshenolo Thato Dumas (biomathematics tutor), Rajae Bentahar, Emmanuel Nwosu, Hosana Ranaivomanana, Dinna Ranirina, Shaun de Carvalho and Joel Lontsi (who is now a postdoctoral researcher in the AIMS Research Centre).

Student Outings

In our ongoing efforts to foster a vibrant learning environment, AIMS organised several student outings and events throughout the year, facilitating rich experiences and meaningful connections for our students.

In September, AIMS Structured Master's students, Ms Martha Mulusa and Mr Enock J Mwenitete, attended the Baobab Summit in Kigali, Rwanda, themed 'A Decade of Transformative Impact & Learning.' The summit served as a platform for reflection on the Mastercard Foundation's mission to provide 100,000 scholarship opportunities. Ms Mulusa was particularly inspired by the stories shared, emphasising the importance of starting small and connecting with others. Her experience motivated her to commit to community service and supporting deserving scholars.



Mr Mwenitete and Ms Mulusa at the Baobab Summit

In October, Prof. Neil Turok, the founder of AIMS, delivered a guest lecture, sharing valuable insights with the students.

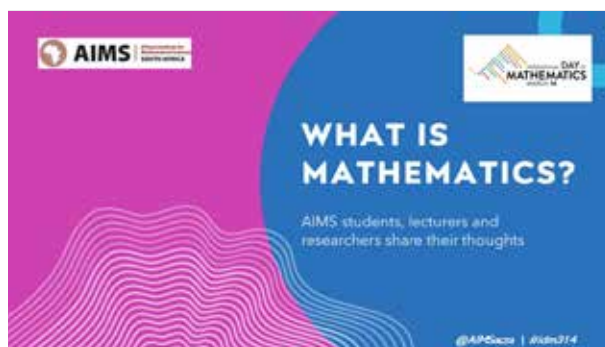


Prof. Neil Turok with students

Students had the opportunity to visit the three partner universities, SU on 8 November, UCT on 9 November and UWC on 16 November 2022. Students also attended a lecture at SU in February 2023 organised by NITheCS titled: 'What are the possible near field structures one can define over the multiplicative group of a near field?' by Dr Leandro Boonzaier (SU) and Dr Sophie Marques (SU).

In March, students visited the Centre for High Performance Computing, gaining exposure to cutting-edge research.

Additionally, the International Day of Mathematics celebration featured enlightening talks: 'Understanding Infinity' by Prof. J Winchler (Heidelberg University) and 'Mathematics and African Arts' by Dr Mafoya Landry Dassoundo (AIMS South Africa). A video featuring AIMS students and researchers answering the question 'What is Mathematics?' was also screened during the event.



These experiences broadened students' perspectives and deepened their passion for learning, fostering a vibrant and engaged scholarly community.



January 2023 Intake

Students on the January 2023 Intake

Full name	Gender	Origin
Clinton Garayi	M	Zimbabwe
Emmanuel Kwarirandunda	M	Zimbabwe
Maitielo Reneilwe Maanaso	F	South Africa
Lusanda Makrwanana	M	South Africa
Edmond Malepane	M	South Africa
Pretty Josias Maphalle	M	South Africa
Ntladi Derick Maserumule	M	South Africa
Faith Buhlebenkosi Matema	F	Zimbabwe
Promise Mathebula	F	South Africa
Siyabonga Phiofillas Mthimkulu	M	South Africa
Rofhiwa Adolph Muthikitha	M	South Africa
Thifundedzwi Nemukula	M	South Africa
Jérémie Mabilia Nlandu	M	Democratic Republic of the Congo
Ontlotlile Frans Nthite	M	South Africa
Oprah Natasha Phiri	F	Zimbabwe
Maria Mankone Ramaoka	F	South Africa
Liteboho Samuel Sekholomi	M	Lesotho
Pheeha Audrey Selabe	F	South Africa
Neo Kevin Sibuyi	M	South Africa
Marry Thekhwe	F	South Africa
Kukhanya Zondo	M	Zimbabwe

BSc Honours with a Focus in Biomathematics

Biomathematics Honours students from Stellenbosch University take some courses at AIMS during the first part of the year. There was one biomathematics student in 2023. Courses with a biomathematics focus that were in the 2023 programme included Algebraic Biology, given by Matt Macauley (Clemson) and Analytical Techniques in Mathematical Biology, given by Lyndsay Kerr (Strathclyde). In July, the MMED (Meaningful Modelling in Epidemiology) conference returned on site to AIMS. An MMED-related course, given by Juliet Pulliam (SACEMA) and Zinhle Mthombothi (SACEMA), was also part of the Biomathematics Honours programme.

Graduations

January 2022 Intake

On 22 November, AIMS South Africa celebrated the accomplishments of 13 students, including 9 South Africans, from the January 2022 intake at a Recognition of Achievement Ceremony held at the Centre.

During the event, Prof. David Holgate, Chair of the AIMS South Africa Council and guest speaker, acknowledged the remarkable achievement of the graduates. He emphasised the privilege they had experienced, being chosen from a competitive group, immersing themselves in mathematics for a year, and becoming part of the extensive AIMS network across Africa. He challenged the graduates to contemplate how they would utilise this privilege as they embarked on their future journeys.

Dr Simukai Utete, Academic Director, announced that Ms Dimakatso Makgoba had won the Women in Combinatorics Award for her project titled 'Learning from the unseen: Waiting time estimation,' supervised by Dr Daniel Nickelsen. This award, initiated in the 2021-22 academic year for all AIMS centres by the group Women in Combinatorics (WinCom), recognises outstanding achievements by women candidates at AIMS centres in combinatorics or related fields. It aims to provide start-up support for a PhD programme and mentoring assistance.

Representing their peers, Ms Fortune Pitsi Lekgwara from South Africa and Mr Kutlwano Othomile from Botswana expressed their gratitude. Ms Lekgwara reflected on the extraordinary achievement, cherishing the friendships and memories forged with fellow dreamers and achievers.

Mr Othomile highlighted the valuable skills acquired during their studies, enabling them to solve mathematical problems using various tools and make a meaningful impact, whether in industry or academia.



Ms Lekgwara



Mr Othomile

Prof. Barry Green, Director of AIMS South Africa, expressed his pride in the students' success: "Everyone at AIMS is deeply invested, and your achievements make us feel even more connected to the rest of the continent."



Recognition of Achievement Ceremony November 2022



AIMS South Africa Graduation June 2023

2022-2023 Intake

On 26 June 2023, AIMS South Africa celebrated its 20th Graduation and Recognition of Achievement ceremony at the centre in Muizenberg. The ceremony honoured the achievements of 32 students from 12 African nations, including 14 women. Seventeen students received their degrees from SU, nine from UCT, and the six graduates from UWC will receive their official degrees at a ceremony to be held later in the year. UWC also conferred degrees in absentia to four students who completed the programme in December last year. This celebration marked a significant milestone, bringing the total number of AIMS South Africa alumni to 1005, with 35% being women.

This ceremony marked a significant milestone as it was the first presided over by Prof. Ulrich Paquet, AIMS South Africa's new Director since January 2023. In his address, he warmly welcomed the attendees to this truly pan-African celebration. Prof. Paquet emphasised the graduates' exceptional efforts, highlighting their intellectual growth at AIMS: "This is your day. You've worked extremely hard. You are the stars of the show. Your minds have certainly been stretched, and you're leaving AIMS with new ways of thinking."

The event featured a speech by Ms. Andrea Böhmert, Co-Managing Partner at Knife Capital, encouraging the graduates to embrace challenges and make a positive impact.

The ceremony was officiated by representatives from the three universities. Prof. Wim de Villiers, Rector and Vice-Chancellor of SU, commended the graduates, highlighting the invaluable skills they have gained, essential for propelling Africa forward. Prof. Daya Reddy, Interim Vice Chancellor of UCT, acknowledged AIMS South Africa's remarkable contribution to the nation's pool of Master's students in the Mathematical Sciences. He emphasised the significance of the over 1000 graduates, recognizing AIMS South Africa's substantial impact. Prof. Bertram Fielding, Dean of Science at UWC, encouraged the graduates to share their knowledge and empower the broader African community, emphasising the transformative potential they hold.

During the ceremony, Ms Mary Kiarie and Mr Enock Ndunda, representing their fellow graduates, shared their heartfelt sentiments. Ms Kiarie expressed, "AIMS has shaped us into

resilient individuals with a deep passion to create a positive impact and improve the world for everyone." Mr Ndunda added, "AIMS has not only equipped us with academic knowledge but has also taught us how to communicate complex mathematical concepts to non-experts. We are driven by a mission, and we pledge to transform the world; it's our responsibility as Africans to transform Africa."

During the ceremony, AIMS Endowed Scholarships were awarded to outstanding students in recognition of their achievements in the Master's program.

- The Stephen Hawking Scholarship, named after the renowned physicist, was awarded to Mr Elmar Constant Lasa for his notable work on the research project titled 'The Poincaré Conjecture across dimensions,' supervised by Prof. Jeff Sanders at AIMS South Africa.
- Ms Kelie Marline Momo Nizegha received the Martin Rees Scholarship for her exceptional contribution to the project 'Persistent Homology: Theory and Applications,' completed under the supervision of Dr Maria Vivien Visaya from the University of Johannesburg and Dr Cerene Rathilal from the University of KwaZulu-Natal.
- The Paul G. Allen Family Foundation Scholarship was presented to Ms Sarah Gakii in recognition of her research project titled 'Modelling the Impact of Human Behavior on COVID-19 Vaccine Uptake,' supervised by Dr Josephine Wairimu Kagunda from the University of Nairobi.

In addition Mr Andrinaiaina Kevinn Adolha Rajaona received an Academic Excellence Award.



Dr Utete, Ms Nizegha, Mr Rajaona, Ms Gakii, Mr Lasa and Prof. Paquet

Graduate Profiles



Nombali Qodi
AIMS South Africa 2022

Nombali completed an undergraduate degree in Applied Mathematics and Physics at the University of Fort Hare and an Honours degree in Astrophysics and Space Science at UCT. She graduated from AIMS South Africa in June 2023 and is currently a Cloud Engineer Intern at Altron Systems Integration.

In 2022 Nombali joined AIMS to pursue her career in mathematics, and during her Master's she joined the House of Science as a volunteer where she got to experience training in public engagement. She desires to expose herself to various aspects of science, data analysis, teaching, and finding solutions to problems.

"As a former mathematics tutor and educator assistant I have developed the love and skills of teaching young ones maths and science and I hope to pursue a career in teaching by furthering my studies through UNISA."



Prince Ndivhuwo Tshivhasa
AIMS South Africa 2022

Prince obtained his undergraduate degree in Mathematical Sciences from the University of Limpopo in 2020. In 2021, he pursued an Honours Degree in Statistics, which he completed a year before joining AIMS.

While at AIMS, he actively volunteered with the House of Sciences as a facilitator and event organiser. He also served as the student representative for the January 2022 intake group. His time at AIMS culminated in the successful completion of his research project, titled "Likelihood, Score, and Wald Confidence Intervals for Normal Linear and Nonlinear Models," which was conducted under the guidance of Prof. Timothy E O'Brien.

Currently, Prince is doing a graduate programme at SEACOM South Africa, a telecommunications company, where he holds the role of BI Analyst. He has plans to further his education by enrolling in a Master's programme in Data Science, aiming to enhance his skills and advance his career.

Reflecting on his AIMS experience, Prince shares, "My time at AIMS challenged me to step out of my comfort zone and strive harder to achieve my goals."



Enock Ndunda
AIMS South Africa 2023

Enock from Zambia obtained his Bachelor's degree in pure mathematics from the Copperbelt University in Zambia in 2020 and graduated from AIMS South Africa in June 2023.

During his time at AIMS, Enock served as a student assistant and volunteered with the House of Science. His master's thesis, titled "Fault Detection of Process Signals Using Singular Spectrum Analysis (SSA) and Neural Component Analysis (NCA)," was supervised by Prof. Syamala Krishnannair from the University of Zululand. Enock has a deep understanding of the significant role mathematics plays in driving social and economic development. "I am passionately committed to advancing economic freedom in Zambia and Africa at large, and I recognise that mathematics is a crucial tool in achieving this goal." He has a keen interest in data science and machine learning, which he believes has a direct impact on daily decision-making processes, both in the short and long term. Enock is dedicated to community development efforts.

After graduating he joined the MarcTina consultancy firm as a data analyst. He finds it remarkable how he is transitioning from pure mathematics to applied mathematics. Enock firmly believes that a solid foundation in pure mathematics theory enables individuals to achieve remarkable feats. In the near future, he intends to pursue a PhD in data science. Enock has the aim of developing AI tools applicable in the financial institution across various sectors such as banking, insurance ect.



Eleni Asmare Tarekegn

AIMS South Africa 2023

Eleni, from Ethiopia, earned a Bachelor of Science in Mathematics and a Master's of Science in Mathematics with a specialisation in Algebra from Bahirdar University in Ethiopia.

She worked as a lecturer for three years at Adama Science and Technology University and Jinka University in Ethiopia, before joining AIMS South Africa in 2022.

"I am very interested in being a mathematical researcher in the areas of algebra and graph theory. So, my dreams came true when I was accepted as an AIMS student. AIMS was tough and had lots of challenges but those challenges have made me a more independent and confident woman."

Her research project at AIMS was titled 'A survey on the domination number of the zero-divisor graphs of (some) commutative rings' done under the supervision of Dr Elham Mehdi-Nezhad from UWC. She is currently busy with a PhD at the University of Waterloo, Canada, for which she received a fully funded scholarship.



Elivin Nyanchama Akama

AIMS South Africa 2023

Elivin joined AIMS South Africa in 2022 after completing a Bachelor of Science in Actuarial Science (First Class Honours) from the University of Nairobi in Kenya.

During her time at AIMS, she participated in programmes like the Mathematics in Industry Study Group, African Scientific and Industry Immersion Programme which sparked her deep interest in Data Science and Analytics.

"AIMS not only brought out the best in me but also provided me with an experience I will forever cherish and be profoundly grateful for."

She is currently gaining practical experience as a finance intern at the Central Bank of Kenya working on a project focusing on predictive analytics for economic indicators, all while eagerly anticipating the opportunity to become part of the Data Science and AI fellowship in Germany one day.

Elivin's journey is a testament to her dedication and her pursuit of knowledge in the exciting world of data science and artificial intelligence. Motivated by her own experiences she mentors high school female students in Kenya, inspiring and encouraging them to pursue the rewarding careers in STEM.

Post AIMS: Support, Opportunities and Alumni

Progress of Recent Students

Full name	Gender	Origin	Institution	Programme/Position
Graduates from January 2022 Intake				
Madoda Kenny Dendeng	M	South Africa	Bidvest Bank	Credit Risk Analyst
Ganinshuti Pierre Damien Kabyare	M	Rwanda	Still exploring opportunities	
Bralyne Vanessa Kamga Matoukam	F	Cameroon	Nelson Mandela University Meteorological Department of Kenya	Internship Internship
Surprice Makgafela Koto	M	South Africa	Joburg City Power	Data Scientist Internship
Fortune Pitsi Lekgwara	F	South Africa	Standard Bank	Quantitative Analyst Internship
Tshepo Mahura	M	South Africa	Woolworths	Advanced Analytics Graduate
Dimakatso Makgoba	F	South Africa	Still exploring opportunitites	
Phemelo Pabalelo Morao	M	South Africa	Still exploring opportunitites	
Denzel Spencer Ngwenya	M	Zimbabwe	TelOne Zimbabwe	Financial and Operational Risk Analyst
Kutlwano Othomile	M	Botswana	University of Botswana	PhD
Nombali Qodi	F	South Africa	Altron Systems Integration	Cloud Engineer Internship
Enala Sakala	F	Zambia	Still exploring opportunitites	
Percy Tshikororo	M	South Africa	FNB	Quantitative Analyst Graduate Trainee
Prince Ndivhuwo Tshivhasa	M	South Africa	Standard Bank	Data Scientist
Khanyiswa Tyabule	F	South Africa	FirstRand Corporate Centre	Quantitative Graduate Trainee
Graduates from 2022-2023 Intake				
Amna Abdelrahim Osman Ahmed	F	Sudan	IIP	
Elivin Nyanchama Akama	F	Kenya	IIP Central Bank of Kenya	Finance Intern
Sharon Chepkemai Maritim	F	Kenya	IIP	
Mohamed Hussien Abdelhameed Elfadul	M	Sudan	Still exploring opportunitites	
Abubakar Mastour Adam Fadul	M	Sudan	Max Planck Institute for Astronomy, Germany	Internship
Sarah Gakii	F	Kenya	Bowling Green State University, USA	Research Master's
William Kalukango	M	Zambia	Still exploring opportunities	
Wisdom Patrick Kapinga	M	Malawi	IIP DMI-St. John the Baptist University, Malawi	Lecturer
Mary Wambui Kiarie	F	Kenya	Technical University of Kenya	PhD
Victoria Ndunge Kioko	F	Kenya	IIP Zeri Capital Limited, Kenya	Research Analyst
Elmar Constant Lasa	M	Madagascar	Clemson University, USA	PhD



Khumbulani Similo Lukhele	M	Eswatini	IIP	
Nonofo Madigele	M	Botswana	Still exploring opportunities	
Wandile Thokozani Manyatsi	M	Eswatini	IIP	
Casimiro Alfredo Mavanga	M	Mozambique	Still exploring opportunities	
Helarie Rose Medie Fah	F	Cameroon	IIP University of Kwazulu-Natal	PhD
Lesego Mokgabudi	M	South Africa	IIP Sage	Data Analyst Internship
Kelie Marline Momo Nizegha	F	Cameroon	Still exploring opportunities	
Jenipher Mutale	F	Zambia	IIP	
John Kivala Mutunga	M	Kenya	Jomo Kenyatta University of Agriculture and Technology, Kenya	Research Master's
Ann Lilian Wangui Mwangi	F	Kenya	Tohoku University	Internship
Marjory Mwanza	F	Zambia	YAM Fellowship at the University of Münster, Germany	Internship
Enock Ndunda	M	Zambia	MarcTina Consultancy Limited, Zambia	Data Analyst
Just Fontaine Nguimatio Dongmo	M	Cameroon	IIP IS Dev Experts	Python Developer and Data Scientist Internship
Musa Njie	M	Gambia	IIP	
Moses Katenje Phiri	M	Malawi	Malawi Government	Secondary school teacher
Andriniaina Kevinn Adolha Rajaona	M	Madagascar	Still exploring opportunities	
Fanomezantsoa Fabrice Razafimahatratra	M	Madagascar	Clemson University, USA	PhD
Blen Belete Shebeshe	F	Ethiopia	YAM Fellowship at the University of Münster, Germany Bonn University	Internship Research Master's
Happy Siame	M	Zambia	IIP UWC	PhD
Beatrice Similindi	F	Zambia	University of Johannesburg	Research Master's
Eleni Asmare Tarekegn	F	Ethiopia	University of Waterloo, Canada	PhD
Khadija Mohammed Musa Windo	F	Sudan	IIP Still exploring PhD opportunities	

Internships

Two 2022-23 AIMS Master's students, Ms Blen Shebeshe from Ethiopia and Ms Marjory Mwanza, from Zambia, were selected for the Young African Mathematician research internship hosted at the University of Bonn. YAM enables young, talented and highly motivated AIMS graduates to get to know the HCM in Bonn and immerse themselves in a field of academic and research excellence. This insight into a highly skilled international research environment is intended to have a lasting influence on their continuing personal and professional development.

Ms Ann Lilian Wangui Mwangi, also a graduate from the 2022-2023 intake, completed a six-week internship in Japan. The visit was made possible through a partnership agreement with Tohoku University.

AIMS-IVADO Fellowship Programme

The Institute for Data Valorization (IVADO) and AIMS formalised their partnership to enhance skills development of African youth in emerging technologies. Based on identified synergies and common interest, AIMS and IVADO agreed to join forces to promote and build capacity of the next generation of data science and AI researchers in Africa. The main objective of this programme is to provide AIMS graduates with international research exposure to boost their technical and professional skills in data science and AI, while contributing to assigned research projects.

Structured Master's students from the 2021-2022 intake, Esther Wanangachi Lwazi, Dumisani Lickson Namakhwa and Happiness Edit Mahlalele were selected for this internship programme and completed internships in Canada.

Industry Immersion Programme

The Industry Immersion Programme (IIP) continues its mission to enhance the employability of exceptional university graduates across Africa. Operating across five campuses, the programme offers a comprehensive supplementary curriculum for those aspiring to careers in industry or business.

Combining academic and practical learning, the IIP equips participants with skills vital for transitioning from academic environments to applied industry settings. A key component is the internship module, commencing five weeks into the programme, where participants gain firsthand experience in a business environment, applying their academic knowledge. Business and soft skills are imparted by lecturers from ESMT Berlin, the University of Victoria in Canada, and SU.

In July 2023, the IIP team trained a total of 111 students from AIMS, Strathmore University, and the University of Ghana, including 14 students from AIMS South Africa. The programme, conducted from 3 July to 4 August 2023, featured lectures by experts from ESMT Berlin, including an onsite session 'Introduction to General Management' by Prof. Zoltan Antal-Mogos held at AIMS South Africa. At its conclusion, students received a business management certificate endorsed by ESMT Berlin.

Currently, the IIP team is collaborating with students to initiate their internships in their home countries. This year, the support from Dr Jost Henkel Stiftung in Dusseldorf, Germany, has been invaluable. This backing provides stipends to students when companies are unable to remunerate them, aiding their smooth transition into the professional world.

The table below gives details of the placement of South African students who completed the programme in 2022.

For the January 2022 intake students unable to attend the July IIP programme, a condensed training session was conducted in November 2022. Following this, a partnership with Standard Bank South Africa (SBSA) facilitated placements starting 1 February 2023. Out of 14 students interviewed by SBSA, 11 were selected for roles. Subsequent evaluations revealed that three candidates secured full-time positions, with two more currently under consideration for permanent roles, showcasing the programme's efficacy in fostering meaningful employment opportunities.

Placement of South African Students

Full name	Gender	Origin	Internship Company	Role
Seithati Ntumeang	F	South Africa	South32 Min	Technical Analyst
Ramatsimela Lebogang Mphahlele	F	South Africa	Standard Bank South Africa	Data Analyst
Thandiwe Njephe	F	South Africa	African Bank South Africa	Credit Risk Analyst
Musawenkosi Khulu	M	South Africa	Altron System Integration	Cloud Engineer
Nkgaphe Tebatjo Tsebesebe	M	South Africa	CSIR	PhD Studentship



AIMS South Africa IIP participants July 2023

Alumni Profiles



Kouagou N'Dah Jean

AIMS South Africa 2019

Before joining AIMS South Africa, Jean completed his Bachelor's degree in mathematics at the University of Abomey-Calavi and pursued the first semester of a Master's in Pure Mathematics at IMSP, Porto-Novo.

He chose AIMS due to its English instruction, essential in scientific pursuits, and the comprehensive bursary covering expenses. AIMS facilitated his growth in computer skills and English proficiency while fostering connections with diverse peers. He engaged in the Industry Immersion Programme in 2019 and completed the African Master's in Machine Intelligence at AIMS Ghana in 2020, where he learned advanced machine learning techniques from industry experts like Google and Facebook.

Currently in his third year of a Neuro-Symbolic AI PhD, Jean also serves as a Research Assistant at Paderborn University. His journey, shaped by AIMS, showcases his dedication and the institution's transformative impact.



Abu Bakr Elbukhari Mohamed Mohamed Tom

AIMS South Africa 2016

Abu's journey began in a humble Sudanese village where he faced the challenge of walking over an hour to reach the nearest school. Despite these hardships, his passion for mathematics flourished, inspiring him to excel. Abu achieved first-class honours in Mathematics from the University of Khartoum's Faculty of Education. In 2016, he joined AIMS in South Africa, completing his Master's in Mathematical Sciences.

His choice of AIMS was driven by its reputation as Africa's mathematical sciences cornerstone, featuring exceptional lecturers from across the globe. Abu praised the support of the administrative staff and dedicated tutors, unique to AIMS. He found unparalleled learning experiences here, emphasising, "AIMS was different; the skills I gained here are unmatched."

Returning to Sudan, Abu became a lecturer at the University of Khartoum. His AIMS-acquired expertise swiftly led to a promotion as Senior Lecturer. Currently, he continues his impactful work at the university and has been awarded a PhD scholarship to Yangzhou University in China.

Reflecting on his AIMS experience, Abu acknowledged the transformative power of the opportunities provided. He highlighted the invaluable coding and programming skills acquired, shaping his teaching methods in an African university. Abu remains committed to his students, inspired by the transformative career experience AIMS bestowed upon him.



Dr Justine Nasijje

AIMS South Africa 2012

Justine, originally from Uganda, is now a lecturer at the School of Statistics and Actuarial Science at the University of Witwatersrand, South Africa. Her research focus lies in SDG 3: Good Health and Well-Being, with significant contributions made to understanding the drivers of Under-Five mortality rates in Africa. Justine adeptly tackles challenges faced by researchers when analysing complex datasets, employing advanced statistical and machine learning methods to derive meaningful insights in the realm of public health.

Her academic journey traces back to Makerere University, Uganda, where she completed a Bachelor of Science in Education, majoring in Mathematics. Inspired by a lecturer's recommendation, she pursued her Postgraduate Diploma in Mathematics at AIMS South Africa in 2011. Justine credits AIMS with igniting her passion and broadening her perspective on the myriad ways mathematicians can contribute to diverse fields. This experience propelled her towards an academic career in Biostatistics, recognising the pivotal role her mathematical skills play in addressing crucial public health issues in Africa and beyond.

AIMS served as the cornerstone for her professional trajectory. Following her time at AIMS, she pursued and completed her Master's and PhD at the University of KwaZulu-Natal. Justine not only presented her research findings at both local and international conferences but also published her work in esteemed peer-reviewed journals. Her journey exemplifies the transformative impact of AIMS, shaping her into a dedicated researcher and educator in the field of Biostatistics.

Research

Through a broad spectrum of activities ranging from pioneering machine learning applications in ecology to advancing mathematical theories and engaging in international collaborations, our researchers and students have made significant strides in pushing the boundaries of knowledge and addressing critical global challenges.

Our institution has also been a hub for seminars and symposia that bring together minds from various disciplines. The Nobel in Africa Symposium, the Topology Seminar, and the Journal Club are just a few platforms where our researchers and invited scholars share insights, fostering an environment of learning and intellectual growth. Moreover, our commitment to the integration of modern technological advancements in academia and industry is showcased through initiatives like the Digital Transformation Workshop 2022 and the Large Language Models (LLM) Workshop 2023. These programmes reflect our dedication to preparing the next generation of scholars and professionals for the challenges and opportunities of the digital age.

Dr Emmanuel Dufourq, the AIMS Canadian Junior Research Chair in Climate Science, has been leading the Machine Learning for Ecology Group since April 2023. The group has grown significantly and has attracted international students and collaborators. Group members have presented their research at various international events, and have contributed towards the development of open-source software to increase the impact that machine learning can have on critical conservation issues. Through the innovative use of passive acoustic monitoring paired with machine learning, the group has not only streamlined the process of studying the critically endangered animals, such as the world's rarest primate and the black-and-white ruffed lemur in Madagascar, but have also unveiled the first quantitative, published evidence of lemur nocturnal vocal activities in Madagascar. These lemurs are one of the world's most endangered mammals, and machine learning models have been developed for various other species around the world.

Researchers and students have presented their research locally in South Africa, and internationally at various events in Poland, France, Germany, Tunisia, Rwanda, United Kingdom, Cameroon and Czech Republic. AIMS South Africa has hosted journal talks, ranging in topics from large language models, mathematics for industry, to climate crisis. AIMS South Africa has created its own Github repository which will host research software produced by researchers at AIMS. The Machine Learning for Ecology Group has released various open-source projects as a means of decreasing the barrier to entry for wildlife monitoring and machine learning techniques.

As we present this overview below, we invite you to delve into the details of our research outputs, workshops, conferences, and the profound contributions of our researchers and collaborators. Our journey reflects a blend of intellectual rigour, innovative research, and a commitment to contributing to global knowledge.

A Selection of Research Findings

Dr Dufourq and Dr Lorène Jeantet collaborated with an international team of scientists from the City University of New York, the University of Antananarivo and Centre ValBio in Madagascar, where they leveraged the power of deep learning to transform an approach to primate conservation. Through the innovative use of passive acoustic monitoring (PAM) paired with machine learning, the team has not only streamlined the process of studying the critically endangered black-and-white ruffed lemur in Madagascar, but have also unveiled the first quantitative, published evidence of their nocturnal vocal activities. These lemurs are one of the world's most endangered mammals. The study took place in Ranomafana National Park, Madagascar over several months. The figure below provides a spectrogram, a snapshot of sound, which reveals the vocalisations of the ruffed lemurs. The machine learning models were tasked to find these vocalisation events within over a terabyte of audio data.

While PAM and automated detection models have long been utilised in marine mammal research, their application in studying non flying terrestrial mammals, especially in primatology, remains relatively underexplored. This is particularly striking given Madagascar’s rich biodiversity and the alarming rate at which it has lost half of its forests over the past 60 years, making the need for innovative conservation methods like PAM more critical than ever.

This research demonstrates the efficacy of PAM and machine learning over traditional methods, offering a solution that is not only cost-effective but also scalable, requiring significantly less labour and time. By combining simultaneous PAM and focal follows, this study not only compares these methods but also highlights the undeniable benefits of integrating technology with conservation efforts. The team collected 2,300 hours of audio data which was processed at AIMS, and jointly analysed with researchers at the City University of New York. Jointly, the team from AIMS produced open-source easy-to-use software to decrease the barrier to entry for PAM and machine learning.

Research Visits

Following the fourth COVID-19 wave in South Africa, our researchers began a dynamic period of academic exchange, intellectual growth, and international collaboration. These visits underscore our commitment to fostering global partnerships, and highlight the innovative and impactful work undertaken by our researchers. The following visits took place:

- From 10 August to 1 October 2022, Rockefeller was invited for a research stay by the Chair of Mathematics of Information Processing at RWTH University of Aachen in Germany. On 25 August 2022, he delivered a talk on ‘Modelling chaotic dynamical systems using Historical Consistent Neural Networks’.
- From August to December 2022, Dr El Bahja was on a research visit at the Technical University of Berlin, Germany.
- Dr Dufourq and Dr Jeantet had a research visit in Rwanda in May 2023, where they discussed potential research projects and presented their research.

The following visitors were also hosted in the Research Centre during the period under review:

- Prof. Kara Abdul, a researcher in the field of Differential Equations from the University of the Witwatersrand visited on two occasions, 12 to 17 September 2022 and 3 to 14 January 2023.

- Prof. Sameerah Jamal, a researcher in the field of Differential Equations also from the University of the Witwatersrand visited from 11 to 16 September 2022 and 28 November to 5 December 2022.
- The Machine Learning for Ecology Research group hosted Mr Frank Fundel from Germany as a student affiliate between October 2022 and January 2023. Mr Fundel worked on machine learning algorithms for bat bioacoustics.
- Mr Gabin Maxime Nguegang, a PhD student working from Aachen University conducting research in Data Science visited from 12 November to 10 December 2022.
- Dr Marta Spinelli, ETH Zurich, and Dr Alberto Cazzaniga, AREA Science Park, Trieste, 29 January to 8 February 2023.

heiAIMS Project

The kick off meeting for heiAIMS which is a three-year-project to develop cooperation between Heidelberg University and AIMS into a sustainable partnership was held at IWR, Heidelberg from 10 to 12 July 2023. Attendees from AIMS were Prof. Ulrich Paquet, Dr Emmanuel Dufourq, Dr Sabine Chebbi, Dr Mafoya Landry Dassoundo, Dr Lorene Jeantet and Ms Lynne Teixeira.

The meeting included formal presentations by the two partners (the Interdisciplinary Centre for Scientific Computing (IWR) and AIMS), scientific presentations, and planning for the three-year programme of workshops, student exchanges and outreach activities.

The partnership activities are funded by the Baden Württemberg Stiftung.



In Memoriam

It is with great sadness that AIMS South Africa announced the passing of Prof. Ronnie Becker on 26 March 2023. Prof. Becker was a Senior Resident Researcher at AIMS South Africa and an Emeritus Professor at the University of Cape Town (UCT). His undergraduate work was done at UCT partly under D B Sears and he received a PhD under Norman Levinson at MIT. From 1964 until retirement he was a member of the Department of Maths and Applied Maths at UCT, continuing to work thereafter at UCT. His interests lay in the areas of Differential equations (Ordinary, Partial and Abstract), Theoretical Computer Science (Sorting Networks and Artificial Intelligence), Operations Research (Optimization Problems on Graphs) and Mathematical Finance (Malliavin Calculus, American Options through Filtering, Multicurve Applications, Applications of Lèvy Processes). Since retirement he has taught and administered programmes in Mathematical Finance and supervised many Master's and PhD students. He was appointed as a Senior Resident Researcher in the AIMS South Africa Research Centre from 1 August 2009 where he made an enormous contribution. He will be missed.



Resident Researchers

Full name	Current Position	Gender	Area of Research
Dr Bubacarr Bah	German Research Chair (appointment ended 31 December 2022)	M	Applied mathematics and Data Science
Prof. Bruce Bassett	Senior Resident Researcher	M	Cosmology and astrophysics
Dr Emmanuel Dufourq	AIMS Canadian Junior Research Chair in Climate Science ended on 31 July 2023, new appointment as Resident Researcher	M	Machine learning for ecology
Dr Rejoyce Gavhi-Molefe	Resident Researcher	F	Computational mathematics: subdivision
Prof. Barry Green	Senior Resident Researcher (appointment ended 31 December 2022)	M	Pure mathematics
Prof. Cang Hui	South African Research Chair Mathematical and Theoretical Biosciences (SU-AIMS)	M	Mathematical and theoretical physical biosciences
Prof. Ulrich Paquet	Senior Resident Researcher	M	Artificial Intelligence and Machine Learning
Prof. Jeff Sanders	Senior Resident Researcher	M	Theoretical computer science
Dr Mario Santos	South African Research Chair in Cosmology with Multi-Wavelength Data (UWC-SAAO-AIMS)	M	Cosmology and astrophysics
Dr Simukai Utete	Senior Resident Researcher	F	Robotics

Postdoctoral Fellows

There were 7 postdoctoral fellowships during the period under review

Full Name	Origin	Gender	Start date to end date	Research Field	Supervisor/Host
Sabrina Chebbi	Tunisia	F	1 April 2022 – 31 March 2024	Multi-armed Bandit, Theory and Application in Communication Networks	Dr B Bah
Hamid El Bahja	Morocco	M	1 April 2022 – 31 March 2024	Physics Aware Learning	Dr B Bah
Lorène Jeantet	France	F	1 April 2022 – 31 March 2024	Machine learning for ecology	Dr E Dufourq
Martha Kamkuemah	Namibia	F	1 July 2022 – 30 June 2024	Specification and Validation of Artificial Intelligence-based Internet of Things Systems	Prof. J Sanders
Jan Keet	South Africa	M	1 August 2022 – 1 July 2024	Spatio temporal dynamics of rhinoceros in the Kruger	Prof. C Hui
Joel Lontsi Sob	Cameroon	M	1 April 2023 – 1 March 2024	Machine learning for ecology	Prof. U Paquet & Dr E Dufourq
Ines Takong	Cameroon	F	1 August 2022 – 31 July 2024	Classification of High Frequency Trade direction using Machine Learning: Application to the South Africa Financial Data	Prof. B Green

Postgraduate Students in the Research Centre

The number of students hosted by the AIMS Research Centre and supervised by AIMS resident researchers totalled 34 during the period under review. Thirteen of these are doctoral students. The students who have graduated are asterisked in the tables below.

PhD Students

No	Full Name	Origin	Gender	Research Topic	Study duration	Supervisor/Host	Based at
1	Everlyn Asiko Chimoto	Kenya	F	Neural Machine Translation for low-resource languages	Upgraded from MSc to PhD February 2023 (ongoing)	Prof. B Bassett	AIMS/UCT
2	Benjamin David Du Toit	South Africa	M	A Spatial Explicit Maximum Entropy Ecological Model	1 January 2017 (ongoing)	Prof. C Hui	SU
3	Ephifania Geza*	Zimbabwe	F	A probabilistic approach for modeling natural selection in pinpointing ancestry along the genome of an admixed individual	24 August 2015 – 31 December 2022	Prof. N Mulder	AIMS/SU
4	Buri Gershon	Uganda	M	Disease prognosis via high-throughput sequencing and machine learning	6 September 2016 (ongoing)	Dr W Ndifon	AIMS/SU
5	Mmatlou Kubyana	South Africa	M	Structure and stability of multilayer networks	1 March 2020 – March 2024	Prof. C Hui	SU
6	Vitalis Kimutai Lagat*	Kenya	M	The evolutionary response of ecological networks to a disturbed environment	1 May 2017 – 31 December 2022	Prof. C Hui	SU
7	Richard Gibbs	South Africa	M	Modelling adaptive movement behaviours of large mammals subject to environmental changes in sub-Saharan Africa	1 January 2022 (ongoing)	Prof. C Hui	SU
8	Samuel Ofose Mensah	Ghana	M	Detecting Diseases on the Retina using Deep Learning Techniques	1 February 2019 (ongoing)	Dr B Bah & Prof W. Brink	AIMS/SU

9	Rockefeller	Cameroon	M	Deep Learning Approaches for Wind Power Forecasting	1 January 2020 (ongoing)	Dr B Bah & Prof. V. Marivate	AIMS/SU
10	Emmanuel Kabuga	Burundi	M	Applications of similarity learning networks in Ecology	1 April 2021 (ongoing)	Dr B Bah & Dr. Ian Durbach	UCT
11	Lorenzo Ruaro	Italy	M	Spatial population modelling of southern white rhinoceros, <i>Ceratotherium simum simum</i>	1 January 2020 (ongoing)	Prof. C Hui	SU
12	Abdulahaman Lawal Suleiman	Nigeria	M	Modelling thermal adaptation of physiological reaction norms with adaptive dynamics	1 January 2018 (ongoing)	Prof. C Hui	SU
13	Carolina Marques	Portugal	F	Developing machine learning tools for automatic detection and classification of wildlife sounds	8 November 2022 (ongoing)	Prof. T Marques, Dr E Dufourq & Dr C Donovan	University of Lisbon

Research Master's Students

No	Full Name	Origin	Gender	Research Topic	Study duration	Supervisor/Host	Based at
1	Dorcas Asare	Ghana	F	Data-driven approaches to identifying anomalies in African disease data	1 July 2022 (ongoing)	Dr B Bah & Dr Gibril Jobe	AIMS
2	Vedanth Baiju*	South Africa	TBC	Word Sense Disambiguation through Deep Learning	1 February 2021 - 30 August 2022	Dr E Dufourq	UCT
3	Dean Blackburn	South Africa	M	Convolutional neural network filter selection for passive acoustic monitoring models	1 December 2021 (ongoing)	Dr E Dufourq & Dr L Jeantet	AIMS/SU
4	Donavan Broughton	South Africa	M	Evolving encapsulated neural network blocks	1 December 2021 (ongoing)	Dr E Dufourq	AIMS/SU
5	Roanne Coetzer*	South Africa	F	Developing a penguin posture estimator to study penguin behaviour	1 January 2022 – 1 November 2022	Dr E Dufourq, Prof. S Beery & Dr A Bastian	SU
6	Thembelihle Rose Dlamini	Eswatini	F	Mitigating errors in quantum annealing	29 April 2022 (ongoing)	Prof. H Touchette & Dr D Nickelsen	SU/AIMS
7	Wesley Douglas	South Africa	M	Predicting future spread of invasive species across the Kruger National Park	1 February 2022 (ongoing)	Prof. C Hui	SU
8	Tomas Gueifão	Portugal	M	Estimating cue rates for beaked whales via convolution neural networks: a stepping stone into passive acoustic density estimation of beaked whales	27 December 2021 (ongoing)	Prof. T Marques, Dr E Dufourq & Dr K Gkikopoulou	University of Lisbon
9	Charles Herbst	South Africa	M	Machine learning for data-scarcity and bioacoustics	1 March 2022 (ongoing)	Dr E Dufourq & Prof. A Engelbrecht	AIMS/SU
10	Nonhlanhla Luphade	Zimbabwe	F	Automated classification of Hainan Gibbon call type using deep learning	1 January 2021 (ongoing)	Dr I Durbach, Dr E Dufourq & Mr S Britz	UCT
11	Alvin Reabow	South Africa	M	Classification of Obsessive Compulsive Disorder using Convolutional Neural Networks	12 February 2022 (ongoing)	Dr S Heany, Dr S Er & Dr E Dufourq	UCT
12	Tebogo Malatsi*	South Africa	M	On symmetries and conservation laws of some classes of partial differential equations	1 March 2022 – 31 March 2023	Prof. A Kara	WITS
13	Tendai Mashiri	Zimbabwe	F	Possibility to use robotics in renewable energy systems to reduce carbon emissions	1 July 2023 (ongoing)	Prof. S Utete	AIMS/SU

14	Victoria Okeowo	Nigeria	F	Devising agent-based models for elephant movement and conservation corridors to reduce human-elephant conflict	1 July 2022 (ongoing)	Prof. C Hui	SU
15	Tosin Samuel Osikoyo	Nigeria	M	Modelling the emergence of voltinism in insects	1 July 2022 (ongoing)	Prof. C Hui	SU
16	Milanto Rasolofohery	Madagascar	M	Compressed sensing for machine learning and bio acoustic monitoring	1 October 2022 (ongoing)	Dr E Dufourq	AIMS/SU
17	Matthew Van den Berg	South Africa	M	Posture estimation on the endangered African Penguin adding in depth estimation and creating a more optimised model	1 March 2023 (ongoing)	Dr E Dufourq & Dr L Jeantet	AIMS/SU
18	Joseph Wacira	Kenya	M	Intelligent control for processing solar photovoltaic energy	22 March 2022 (ongoing)	Dr B Bah & Prof. A Vargas	AIMS/SU
19	Mukhtar Yahaya	Nigeria	M	Structural emergence in plant-animal mutualistic network	1 April 2022 (ongoing)	Prof. C Hui	SU
20	Aimé Nshimiyimana*	Rwanda	M	Investigating data augmentation techniques for small bioacoustic datasets	22 January 2021 - 31 July 2022	Dr E Dufourq	University of Rwanda
21	Mikwa Boris Tamanjong*	Cameroon	M	Pre-training neural networks on Xeno-Canto and eBird for bioacoustic classification models	22 January 2021 - 31 July 2022	Dr E Dufourq	University of Rwanda

Presentations at Workshops & Conferences

- In July 2022, Mr A Mirugwe, Dr N Juwa, and Dr Dufourq won the best paper award at SAICSIT 2022, for a paper titled “Automating bird detection based on webcam captured images using deep learning”.
- Dr Bah attended a Dagstuhl Workshop on “Machine Learning for Science: Bridging Data-driven and Mechanistic Modelling” held from 18 to 23 September 2022.
- From 26 to 30 September 2022, Dr El Bahja presented a talk titled “Regularity and existence of solutions of a parabolic double phase equation with variable growth” at the Summer School: Horizons in non-linear PDEs, in Germany
- From 27 to 30 September 2022, Rockefeller took part in the MAELSTORM Boot Camp 2022: Machine Learning for Weather and Climate, in Jülich, Germany
- Dr Chebbi attended the Mathematical Fluid Mechanics in 2022 Conference held from 22 to 26 August 2022 at the Institute of Mathematics of the Academy of Sciences of Czech Republic where she presented some of her PhD results from a paper titled: ‘Discrete Energy behaviour of a damped Timoshenko system’.



Deep Learning Indaba Tunisia August 2022

- Dr Bah attended the Deep Learning Indaba in Tunisia, from 21 to 26 August 2022. Where he participated as a coach for the Ideathon and a judge for the poster competition. He was also part of a panel discussion. Mr Wacira, a Research Master’s student, also attended the Indaba.



Bioacoustics Community Conference October 2022

- Dr Dufourq and Dr Jeantet attended and presented their research in machine learning for conservation ecology at the African Bioacoustics Community Conference 2022 which was held at the Kruger National Park from 3 to 7 October. Dr Dufourq was also invited to be part of a panel session.

- Dr Chebbi gave a talk at the “Against the flow” workshop held in Bedlewo, Poland, from 18 to 22 October 2022.
- Between 14 to 18 November, Dr Jeantet presented a talk titled “Fully convolutional neural network: a new method for automatically identifying sea turtle behaviors from bio-loggers” at the 4th Groupe Tortues Marines France Symposium, in France.
- From 3 to 7 January 2023, Rockefeller delivered training on ‘Data Preprocessing and Feature Engineering techniques’ to Structured Master’s students at AIMS Cameroon, Limbe.



Prof. Paquet

- On 20 February Prof. Paquet gave a talk titled: ‘AI and Chess: A Retrospective and Future Story’ which was arranged by NITheCS.



Mr Wacira

- Mr Wacira, participated in the ‘Foundational Methods in Data Science Training School 2023 in Kigali. The training was organised by Quantum Leap Africa (QLA) in collaboration with AIMS Rwanda and took place from 19 March to 8 April.
- Rockefeller attended the joint Climate Modelling workshop and Gender training workshop at AIMS Rwanda from 1 to 6 April 2023. He also took part in the IFAM-AIMS PhD Seminar online where he gave a presentation titled: ‘An Approach to Modeling Dynamical Systems with Temporally Consistent State Spaces’.
- Mr Mafoya Landry Dassoundo, a Tutor at AIMS South Africa gave a talk titled ‘What is non-associative Lie theory?’ at UWC on 21 April 2023.
- Dr Dufourq and Ms Dlamini attended the From Theory to Practice Workshop hosted by QLA in Rwanda from 24 April to 28 April 2023.



Dr Jeantet and Mr Rasolofohery

- Dr Jeantet and Mr Rasolofohery, attended the ICLR 2023 Workshop on Machine Learning for Remote Sensing in Kigali, Rwanda from 1 to 5 May 2023. Dr Jeantet gave a talk titled: ‘Enhancing acoustic classification using meta-data.’
- Mr Rockefeller attended the Gender Summit in Accra from 8 to 9 June 2023. The theme this year was: Africa’s energy transition pathways and vision of Green New Deal through a gender lens. His contribution included engaging in critical dialogues and discussions on gender-related topics, in order to gain a better understanding of the benefits of gender inclusivity in the AI field.
- Mr Rockefeller took part in the AIMS-University of Liverpool Postgraduate Conference from the 12 to the 16 June 2023 in Liverpool. He delivered a talk titled: ‘An Approach to Modelling Dynamical Systems with Temporally Consistent State Spaces.’
- Dr Jeantet presented a practical coding workshop titled ‘Deep Learning for Bioacoustics’ at the Emerging Bioacousticians Day held from 28 to 30 June 2023 in Saint-Etienne, France.
- Dr Dufourq attended the Automatic Detection for Bioacoustics Workshop at Girton College, University of Cambridge from 3 to 6 July 2023. The purpose of the workshop was to discuss the state of machine learning for bioacoustics and establish new research collaborations.
- Mr Rasolofohery presented a poster titled ‘Passive Acoustic Monitoring of Animal Populations with Compressed Sensing’ and Mr van den Berg, a poster titled: ‘Posture Estimation for the Endangered African Penguin’ at the Deep Learning IndabaX in Cape Town from 12 to 15 July 2023.
- On 13 July 2023, Mr Wacira gave a talk at the Deep Learning IndabaX in Cape Town. His talk was titled: ‘Advances of ML in the Renewable energy sector’. Specifically he spoke of how he is applying ML to solar charge controllers to make solar panels more efficient.



Seminars

Research Talks

Nobel in Africa Symposium

AIMS South Africa hosted a talk by Prof. Francesco Petruccione, part of the Nobel in Africa Symposia Series Outreach Programme, on 21 October 2022. The talk, titled 'Entanglement: From Theory to Quantum Computers,' was aimed at bringing science to a wider audience. The Outreach Programme involved symposium participants delivering public lectures at various institutions, with other speakers including Prof. Neil Turok and Dr Thifhelimba Daphney Bucher. The Nobel in Africa initiative was a collaboration involving STIAS, the Nobel Foundation, the Royal Swedish Academy of Sciences, the Knut & Alice Wallenberg Foundation, and Stellenbosch University. The first Nobel Symposium in Africa took place from October 24 to 28 at STIAS in Stellenbosch, focusing on predictability in science in the Age of AI. This marked a significant occasion as STIAS became the first institution outside Scandinavia to host a Nobel Symposium, promoting research excellence and collaborative scholarship on the continent.

Nobel Laureate Talk

On 16 September Dr Art McDonald, Professor Emeritus, Department of Physics, Engineering Physics & Astronomy, Queen's University and 2015 Nobel Laureate gave a talk to researchers and students at AIMS South Africa. His talk was titled 'Studying the Universe from Deep Underground.' His talk was followed by a finger lunch giving guests the opportunity to chat informally with Dr McDonald.



Dr McDonald

Topology Seminar

AIMS hosted a Topology Seminar on 27 February 2023. This seminar is usually hosted at UWC by Prof. David Holgate, the UWC Research Chair in Mathematics and Applied Mathematics and Chair of the AIMS Council, and it has been decided to host these once a month at AIMS South Africa. Participants include AIMS and UWC research students.



Topology Seminar participants

Journal Club

This is a seminar series of the AIMS Research Centre, where research students, AIMS researchers, visiting researchers and invited speakers present their research. The focus of the talks is to share the journey of obtaining research results including challenges faced and insights gained. The following talks were held in the period under review.

- On 4 October, Prof. Jeff Sanders (AIMS) gave a talk titled 'JC & NFT'
- On 18 October, Dr Martha Kamkuemah (AIMS) gave a talk titled 'Inferring hidden dynamics using a Kalman filter, and an application'
- On 1 November, Prof. David Holgate (UWC) gave a talk titled, 'Understanding strict maps'.
- On 29 November, Associate Professor Sameerah Jamal (Wits University) gave a talk titled 'Symmetry transformations in dynamical systems'.



Prof. Cluver and Associate Prof. Flaxman

- On 24 January 2023, Prof. Lucie Cluver (University of Oxford and UCT and Associate Prof. Seth Flaxman (University of Oxford) gave a talk titled: 'Climate crisis, epidemics and conflict: How can AIMS mathematicians protect Africa's youth?'



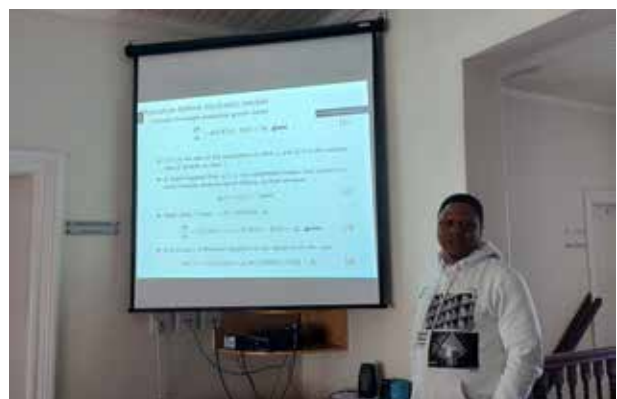
Prof. Lochowshi

- On 7 February 2023, Prof. Rafal Marcin Lochowshi (Warsaw School of Economics, Poland) gave a talk titled 'Local times of real, selfsimilar processes as normalized numbers of interval crossings.'



Dr Motchon

- On 14 February 2023, Dr Dodzi Motchon (Postdoctoral fellow at UCT) gave a talk titled: 'Finite element methods to implement constitutive laws: application to biomechanics and mechanobiology'.
- On 24 March 2023 Dr Alexandra Birch (University of Edinburgh) gave a talk titled: 'Living with Large Language Models'.
- On 11 April 2023, Rockefeller, PhD student in the AIMS Research Centre, gave a talk titled: 'Modelling chaotic dynamical systems with Historical Consistent Neural Networks: Temporal Consistency is all you need!!'
- On 25 April 2023, Dr Stéphane Ouvry, from the French National Centre for Scientific Research. The title of his talk was, 'Inclusion statistics and particle condensation in 2 dimensions.'
- On 23 May, Ashleigh Basel, AIMS South Africa, gave a talk titled: 'The foundations of big data sharing'.
- On 30 May, Musa Hussien, AIMS South Africa, gave a talk titled: 'Insights from Condensed Matter Physics and Density Functional Theory'.
- On 20 June, Prof. Antoine Tambue from Western Norway University of Applied Sciences, Bergen Campus, gave a talk titled: 'Mathematics for industry'.



Prof. Tambue

List of Publications

2022

- Agamah, F.E., Jumamurat R.B, Niehues, A., Njoku, K.F., **Mazandu, G.** et al. (2022) 'Computational Approaches for Network-Based Integrative Multi-Omics Analysis.' *Frontiers in Molecular Biosciences* 9 (November). <https://doi.org/10.3389/fmolb.2022.967205>.
- Bah, B.**, Rauhut, H., Terstiege, U., Westdickenberg, M. (2022) 'Learning deep linear neural networks: Riemannian gradient flows and convergence to global minimizers', *Information and Inference* Volume 11 Issue 1, 307-353.
- Botella, C.; Bonnet, P.; **Hui, C.**, et al (2022) 'Dynamic Species Distribution Modeling Reveals the Pivotal Plant Invasion', *Biology*, 11(1293).
- Cazzolla Gatti, R. (**Hui, C.**) and Souza, A. (2022) 'The number of tree species on earth', *Proceedings of the National Academy of Sciences*, 119(6), pp. 1–11. doi: 10.1073/pnas.2115329119/-/DCSupplemental. Published.
- Crichton, D. (**Bassett, B.A.**) et al. (2022) 'Hydrogen Intensity and Real-Time Analysis Experiment: 256-element array status and overview', *Journal of Astronomical Telescopes, Instruments, and Systems*. SPIE, 8(1), p. 11019. doi: 10.1117/1.JATIS.8.1.011019.
- Deane, D. C. (**Hui, C.**) et al. (2022) 'A null model for quantifying the geometric effect of habitat subdivision on species diversity', *Global Ecology and Biogeography*, 31(3), pp. 440–453. doi: 10.1111/geb.13437.
- Diedericks, G; Broeckhoeven, C. (**Hui, C.**) et al (2022) 'The Role of Directed Dispersal in Driving Genetic and Morphological Structure in Invasive Smallmouth', *Frontiers in Ecology and Evolution*, 9(January), p. 790829. doi: 10.3389/fevo.2021.790829.
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- Falola, O., Adam, Y., Ajayi, O., Kukuthini, J., Adewale, S., et al. 2023. 'SysBioPGWAS: Simplifying Post-GWAS Analysis through the Use of Computational Technologies and Integration of Diverse Omics Datasets.' *Bioinformatics* (Oxford, England) 39 (1). <https://doi.org/10.1093/bioinformatics/btac791>.
- Frimpong, A. (**Ndifon, W.**) et al. (2022) 'Perturbations in the T cell receptor b repertoire during malaria infection in children : A preliminary study', *Frontiers in Imm.* (October), pp. 1–14. doi: 10.3389/fimmu.2022.971392.
- Gatti, R.C., Reich, P.B., Gamarra, J.G.P., Crowther T., **Hui, C.**, et al. *The number of tree species on Earth. Proceedings of the National Academy of Sciences of the United States of America* 2022; 119(6):e2115329119.
- Hynd, R., **Ikpe, D.** and Pendleton, T. (2022) 'Two critical times for the SIR model', *Journal of Mathematical Analysis and Applications*, 505(2), pp. 1–19. doi: 10.1016/j.jmaa.2021.125507.
- Hui, C.**, Richardson, D.M. *Invading Ecological Networks*. Cambridge University Press, United Kingdom 2022:474 pp. (Book)
- Ikpe, D.**, Sithole, Y. and Gyamerah, S. A. (2022) 'On a consistent state-space bond markets model for pricing long-maturity bonds', *International Journal of Financial Engineering*, 0(0), p. 2250024. doi: 10.1142/S2424786322500244.
- Knowles, K. (**Oozeer, N**) et al. (2022) 'The MeerKAT Galaxy Cluster Legacy Survey: I. Survey Overview and Highlights', *Astronomy and Astrophysics*, 657. doi: 10.1051/0004-6361/202141488.
- Liang, J. (**Hui, C.**) et al. (2022) 'Co-limitation towards lower latitudes shapes global forest diversity gradients', *Nature Ecology & Evolution*, 6(10), pp. 1423–1437. doi: 10.1038/s41559-022-01831-x.
- Lou, B., Barbieri, D.M., Passavanti, M.C., **Hui, C.** et al. *Air pollution perception in ten countries during COVID-19 pandemic. Ambio* 2022; 51:531-545.
- Macfadyen, S. (**Hui, C.**) et al. (2022) 'Drowning in data, thirsty for information and starved for understanding: A biodiversity information hub for cooperative environmental monitoring in South Africa', *Biological Conservation*. Elsevier Ltd, 274(April), p. 109736. doi: 10.1016/j.biocon.2022.109736.
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- Mairal, M., García-Verdugo, C., Le Roux, J.L., Chau, J.H, Jansen van Vuuren, B., **Hui, C.** et al. (2022) 'Multiple Introductions, Polyploidy and Mixed Reproductive Strategies Are Linked to Genetic Diversity and Structure in the Most Widespread Invasive Plant across Southern Ocean Archipelagos.' *Molecular Ecology*, no. December 2022: 756–71. <https://doi.org/10.1111/mec.16809>.
- Minnaar, I.A., **Hui, C.**, Clusella-Trullas, S. (2022) 'Jack, master or both? The invasive ladybird *Harmonia axyridis* performs better than a native coccinellid despite divergent trait plasticity.' *NeoBiota* 2022; 77:179-207.

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Nickelsen, D. and Touchette, H. (2022) 'PHYSICAL REVIEW E 105 , 064102 (2022) Noise correction of large deviations with anomalous scaling', *Physical Review E. American Physical Society*, 064102(105), pp. 1–13. doi: 10.1103/PhysRevE.105.064102.

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Workshops & Conferences



Digital Transformation Workshop participants

Digital Transformation Workshop 2022

The in-person segment of the Digital Transformation Programme - Technological Skills for Industry 4.0 took place at Cape Town's Century City Convention Centre from 7 to 11 November 2022. Attended by 43 participants from eight African countries, including two AIMS alumni, the program also drew 20 online attendees. Developed by InnoGlobal, the programme, a version of their Digital Transformation Master's degree, was adapted into the DigiSkills Africa pilot project. Funding for the workshop was provided by the UK Newton Fund through the Development in Africa with Radio Astronomy (DARA) Big Data project, and SARAO and AIMS South Africa were key in implementing the course. The focus was on elevating learners' knowledge of smart factories and the transition of life science manufacturing to Industry 4.0 and Pharma 4.0, encompassing trends, technology's impact, organisational transformation, and ethical considerations.

Topology for Tomorrow Workshop

A workshop for the new generation of South African topologists, was held at AIMS South Africa 2 to 5 December 2022. The workshop was a satellite event of the annual SAMS Congress and aimed to contribute to building a cohort of future topology researchers who will work together and build further international partner-ships. There were 40 participants from across South Africa as well as the international speakers. The AIMS students who took the Topology course in the three weeks prior to the conference also joined the workshop.



MISG Workshop participants

MISG Workshop 2023

The Mathematics in Industry Graduate Modelling Camp and Study Group was held at AIMS South Africa from 10 to 20 January 2023. There were 58 participants which included 13 AIMS Structured Master's students. MISG is a five-day workshop at which academic researchers and graduate students work collaboratively with representatives from industry on research problems submitted by local industry. Study Groups have been organized for over fifty years in many countries around the world. The first Study Group in South Africa was held in 2004. A Study Group is open and free from any non-disclosure agreement with industry.



LLM Workshop participants

LLM Workshop 2023

The LLM workshop organised by Prof. Bruce Bassett explored the potential impact of large language models (LLMs) like ChatGPT on education, academia, and data science. Held from 26 to 30 March 2023, at Zevenwacht Wine Estate, the workshop gathered 27 participants from eight African countries, including alumni, students, professors, and industry representatives. Dr Alexandra Birch from the University of Edinburgh delivered the keynote address. During the event, participants proposed 39 LLM projects, covering areas such as developing apps, code writing assistance, understanding LLMs, and more. Nine projects were presented on the final day, focusing on topics like LLM's thinking abilities, personalised tutoring, language generation, and code translation. Overall, GPT-4 was seen as a significant improvement, but ChatGPT was found delicate to handle, necessitating expert users. The workshop was sponsored by the UK-South African Newton Fund, SARAO, and the South African Development in Africa with Radio Astronomy (DARA) BIG DATA AFRICA Programme, in collaboration with AIMS South Africa and Grailabs.

Women in Mathematics and its Applications Research Day

This one-day workshop was held on 23 March 2023 at AIMS South Africa and showcased research in mathematics and its broad applications done by women in Africa and beyond. Through panels and discussion, it also highlighted opportunities for study, research, and collaborations outside of Africa and within.

The main goals of this workshop were to build a network of African women with common mathematical interests and to increase the visibility of women in mathematics to African students, researchers, and professors. It is hoped that this network will later provide support to participants as they advance through their graduate work and their careers.

The workshop was organised by Prof. Karin-Therese Howell, SU and Prof. Nancy Ann Neudauer, Pacific University, and Associate Secretary of the Mathematical Association of America. Conference support was provided by AIMS South Africa, SU, and the National Graduate Academy of South Africa.



Woman in Mathematics Workshop participants

AIMSSEC

AIMS Schools Enrichment Centre

Introduction

AIMSSEC, the Schools Enrichment Centre of AIMS South Africa, was established in 2003 in Muizenberg. Our professional development programs focus on enhancing the expertise of in-service mathematics teachers in disadvantaged rural areas of South Africa. Through blended and distance learning initiatives, we aim to deepen teachers' content knowledge and introduce effective mathematics teaching strategies. This mission addresses the critical need for capacity building and professional development within the South African mathematics teaching community.

AIMSSEC's key areas of focus include:

- Providing professional development courses for educators from disadvantaged communities.
- Introducing research-informed teaching methods.
- Developing teaching resources suitable for large-class, low-resource environments.

Our intended outcomes are to empower teachers to:

- to become mathematics subject leaders;
- to raise education standards;
- to promote the choice of mathematics as a vital subject at school;
- to train other teachers, and
- to give children from all social strata better life chances.

MCL Online Course

This is the second course in a sequence of seven courses to develop subject leaders and was offered to mathematics teachers at Senior Phase - SP (Grades 7 – 9) and Further Education and Training - FET Phase (Grades 10 – 12) levels. It started on 28 January and was presented over a period of fifteen weeks till 17 June 2023.

AIMSSEC Courses

AIMSSEC endeavours to achieve these outcomes through a series of seven concise Continuing Professional Development (CPD) courses designed to promote subject leadership and engage with students. Each course within this sequence addresses distinct educational challenges faced by teachers:

- I. Mathematical Thinking (**MT**)
- II. Mathematical Communication and Language (**MCL**)
- III. Differentiation and Inclusion in the Mathematics Classroom (**DIMC**)
- IV. Mathematics, Skills, and Competencies for Employment (**MSCE**)
- V. Conceptual Development and Progression (**CDP**)
- VI. Action Research (**AR**)
- VII. Subject Leadership Training (**SLT**)

For the period January to June 2023, AIMSSEC delivered two professional development training courses:

1. The MCL Course sponsored by Standard Bank.
2. The MT4 Course sponsored by the National Skills Fund (NSF).

The courses ran concurrently, up until the closing ceremony for both which was held on 17 June 2023.



Snapshot of attendees during the MCL closing ceremony

Top Academic Achievers:

SP



Nelisiwe Malamlela
1st place



Philani Buthelezi
Joint 2nd place



Nonkululeko Joyce
Joint 2nd place



Naomi Buys
3rd place

FET Phase



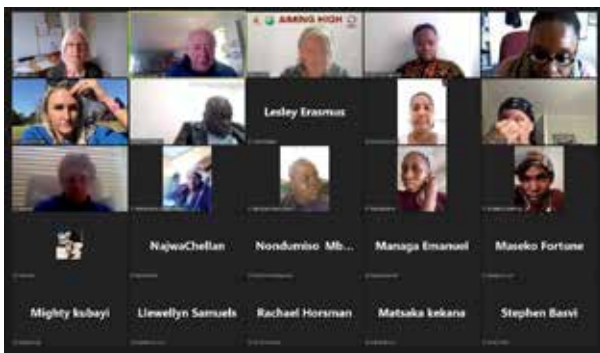
Antonette Jordaan
1st place



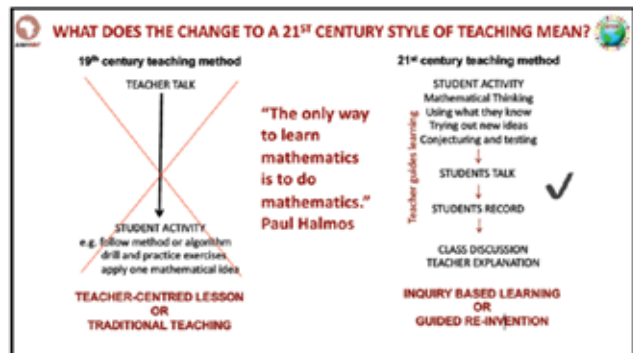
Provia Nemanashi
2nd place



Caleb Mbauya
3rd place



Snapshot of attendees during the MT4 closing ceremony



MT4 Online Course

This course was offered to mathematics teachers at Senior Phase and FET Phase levels. Our focus on the AIMSSEC course remains the transformation from a traditional style of teaching to a 21st Century style of teaching.

The MT course serves as the initial step within AIMSSEC's comprehensive seven-course sequence, culminating in Subject Leader Training Courses. These courses prepare

educators for roles as department heads, NGO teacher trainers, or subject advisors for local government. Upon successful completion of each course, candidates receive an AIMSSEC certificate endorsed by the South African Council for Educators (SACE). The SACE-endorsed MT Course grants participants twenty-five professional development points.

Top Academic Achievers:

SP



Natasha Forrester
1st place



Sunel Crous
2nd place



Sinenhlahl Zwane
Joint 3rd place



Tinyiko Nkosi
Joint 3rd place

FET Phase



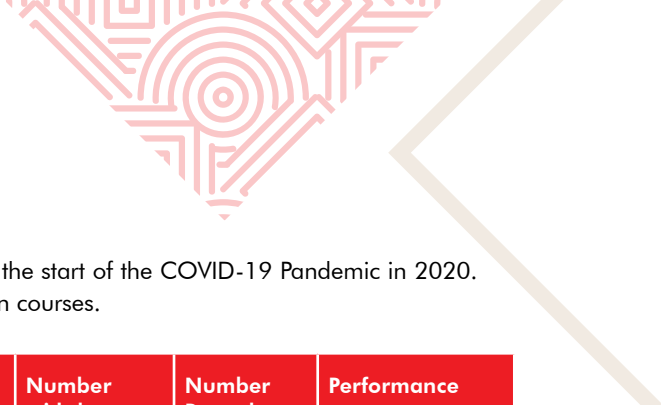
Thuli Maledimo
1st place



Bawinile Nomusa Khoza
2nd place



Llewellyn Samuels
3rd place



The table below gives a summary of SACE endorsed courses taught since the start of the COVID-19 Pandemic in 2020. The MT, MCL and DIMC courses are the first three of the sequence of seven courses.

Date	Course	Mode of teaching	Number of students enrolled	Number withdrew	Number Passed	Performance rate
Jan – June 2020	MT 32	Residential plus Online	55	0	55/55	100%
Aug- Dec 2020	MT 1 Online	Fully online	109	7	85/102	83,3%
Feb – June 2021	MCL 2 Online	Fully online	95	25	64/70	91,4%
Aug – Dec 2021	MT 2 Online	Fully online	75	11	55/64	85,9%
5 Feb – 12 June 2022	DIMC Online	Fully online	77	16	57/77	74%
19 Feb – 12 June 2022	MT 3 Online	Fully online	73	16	54/73	74%
28 Jan – 17 June 2023	MCL 3 Online	Fully online	75	10	65/75	86,7%
35 Feb – 17 June 2023	MT 4 Online	Fully online	79	32	47/79	59,5%
Total			638			

AIMSSEC would like to reintroduce face-to-face residential contact sessions for all future courses.

SAMO Online Courses

Dr Barrie Barnard (AIMSSEC) and Herman Bosman (SAMF) presented a joint session at the **STEMI Community of Practice Conference** which was held in Pretoria from 4 to 6 July. They reported on: ‘How can we use partnerships and collaborations to reach disadvantaged communities so that they benefit and are prepared for a STEMI related future of work?’

The STEMI Conference is a biennial conference which is dedicated to the advancement of the Science, Technology, Engineering, Mathematics, and Innovation (STEMI) through Olympiads and Competitions in South Africa by creating a community of practice where best practices are identified and benchmarked.

Collaborative efforts are required to improve learners’ mathematical competencies. Creative problem-solving skills are very necessary and marketable in today’s technically oriented marketplace. Training teachers and exposing learners to mathematical problem-solving has assisted learners from disadvantaged communities to prepare for the future of work.

The STEMI presentation highlighted the positive impact of a three-year, **multi-stakeholder partnership** on teachers and students in effectively tackling non-routine mathematical problems. In this collaborative effort, the South African Mathematics Foundation (SAMF) engaged AIMSSEC as a service provider to deliver three South African Mathematics Olympiad (SAMO) online courses. These specialised courses were specifically designed for mathematics educators in schools whose students participate in the SAMO, an event organised by the SAMF.

Old Mutual sponsored the SAMO and teacher training course. The measures of the impact of the three courses were:

- number of learners entered for the SAMO competitions;
- teachers’ ability to solve Olympiad type questions – pre-and post-test comparison and
- learners’ ability to solve Olympiad type questions – Olympiad results.

Kathy Jordan, “Massive Open Online Course Completion Rates Revisited: Assessment, Length and Attrition”, June 2015, *International Review of Research in Open and Distributed Learning*, Volume 16, Number 3.

Summary of results over three years

Period	Aug - Dec 2020	Feb - June 2021	Feb - June 2022
Course	MT SAMO 1	LC SAMO 2	DIMC SAMO 3
Enrolled After week 1	109	95	75
Withdrew	7	25	14
Dropout Rate	7/109 = 6,4%	25/95 = 26,3%	14/75 = 18,7%
Distinction	44	22	30
Merit	24	24	18
Pass	17	18	9
Fail	17	6	4
Completion Rate	85/109 = 78,0%	64/95 = 67,3%	57/75 = 76%

This compares well with research done on MOOCs by Kathy Jordan which shows that completion rates (defined as the percentage of enrolled students who completed the course) vary from 0,7% to 52,1% with a median value of 12,6%. Completion rates for online courses are on average as low as 5-15%.

Comparative analysis of DIMC SAMO 3 SP and FET teachers' pre-test and post-test scores

Phase	Number completed both tests	Pre-test score average	Post-test score average	Difference
SP	35	66,48%	71,05%	+4,57%
FET	26	59,74%	64,61%	+4,87%

Comparative analysis of DIMC SP and FET learners' pre-test and post-test overall class averages

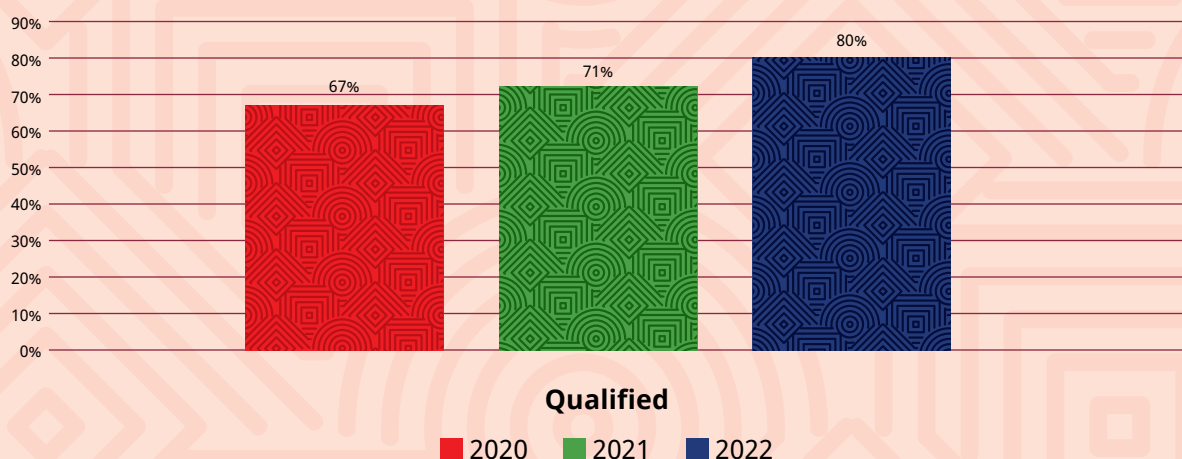
Phase	Number completed both tests	Pre-test score average	Post-test score average	Difference
SP	32	36.38 %	43.66%	+7.28%
FET	24	33.54%	43.29%	+9.75%

School's performance per year

(2nd Round Qualifiers)

South African
Mathematics Foundation

2020 vs 2021 vs 2022



Outreach Activities

AIMSSEC outreach extends around the world through the **AIMING HIGH Teacher Network and App** <https://aiminghigh.aimssec.ac.za> and <https://aimssec.app>. Along with WhatsApp groups for AIMSSEC alumni, this provides a community and free lesson resources and support for teachers.

The 2022 **Global Maths & Science Lesson** took place on 11 October 2022. The annual event involves thousands of participants around the world doing the same thirty-minute lesson on the same day. The thirty-minute lesson in 2022 was about the Golden Ratio with multiple follow up activities on the AIMSSEC Aiming High website: <https://aiminghigh.aimssec.ac.za/category/lesson-activities/>

There were a total of 3,554 participants from fifteen countries around the world.

AIMSSEC's **Daily Maths Starter (DMS)** on Facebook, <https://facebook.com/aimssecsa> together with the weekly broadcast of the **Happy Maths Hour (HMH)**, has a large following of teachers, parents, and home educators.

Once a month AIMSSEC broadcasts the **Global Teacher Empowerment Network (GTEN)** workshops for primary and secondary teachers. The AIMSSEC YouTube Channel has recordings of HMH and GTEN broadcasts and also short videos for use in lessons, specialising in activity/inquiry-based learning and making manipulatives from junk, see <https://www.youtube.com/c/MathsToys>.

Staff Updates



Dr Barrie Barnard

Academic Manager

Dr Barrie Barnard, AIMSSEC's Academic Manager, retired on 31 August 2023, after fourteen-years and six-months of dedicated service to the AIMSSEC family. We wish him a retirement filled with happiness and joy.



Ms Virginia Davidson

Office Manager

After a decade of valuable service, Ms Virginia Davidson, AIMSSEC's Office Manager, retired on 1 December 2022, due to health reasons. We extend our heartfelt wishes for her speedy recovery and a fulfilling life ahead.



Dr Sinobia Kenn

Academic Manager

From 1 September 2023, Dr Sinobia Kenny assumed the role of Academic Manager at AIMSSEC, bringing with her five years of valuable experience within the organisation. We have full confidence in her ability to lead, manage, and inspire all stakeholders, serving as an exemplary role model for both students and staff. Her extensive background in education assures the provision of high-quality course materials, research, and reporting.



Mrs Loveness Mahwire

Mathematics Education Lecturer

Furthermore, Mrs Loveness Mahwire, previously a teaching assistant and tutor at AIMSSEC for three years, will now take on the role of Mathematics Education Lecturer for the Intermediate Phase, starting from 1 October 2023.



Mrs Ntombekhaya Jacobs

Administrative Officer

We are also pleased to announce the appointment of Mrs Ntombekhaya Jacobs as Administrative Officer, effective 1 September 2023.

Conclusion

We extend our heartfelt gratitude to the NSF, Old Mutual, Oppenheimer Memorial Trust, SAMF and Standard Bank for their generous support, which has played a pivotal role in bringing AIMSSEC courses to fruition. Their unwavering dedication to the holistic development of South African children through education is truly commendable.

As an educational institution, we have recognised that many mathematics teachers in South Africa may require further pedagogical training to excel in their roles within our education system. AIMSSEC firmly supports the ongoing upskilling and training of mathematics educators, aiming to equip South African learners with the essential 21st-century skills they need to thrive.

Public Engagement House of Science

Established in 2018 at AIMS South Africa, the House of Science stands as a pivotal hub for driving innovation in science communication and supporting women in STEM fields, both in academia and research. This initiative plays a significant role in advancing societal transformation and enriching AIMS' academic and research programmes.

Operating under the House of Science umbrella, AIMS is dedicated to amplifying science awareness and engagement in South Africa. In alignment with the government's directives outlined in the **Department of Science and Innovation (DSI) Decadal Plan** and **Science Engagement Strategy**, we respond to the call for publicly funded institutions and researchers to demonstrate the broader societal impact of their work.

The House of Science is deeply committed to promoting gender equality, women's empowerment, and transforming the STEM landscape in South Africa and across Africa. Our capacity-building framework focuses on international exchanges and understanding the unique challenges faced by African women. The National Development Plan envisions over 50% representation of women and Black Africans in research and training staff by 2030. However, empowering Black African women in STEM fields remains challenging. Through the House of Science, AIMS tackles these challenges, striving for a more inclusive future in science and technology.

Achievements

In its fifth year, the House of Science has made significant progress – from delivering its capacity-building flagship programmatic activities to producing research publications and providing mentorship to AIMS students and two interns. The House of Science has proven to be an adaptable model that can be rolled out across South African universities and the AIMS Network. During the reporting period, the House of Science successfully delivered two flagship programmes: Africa Scientifique and Women's Advancement Forum: International Exchanges, Research & Academia (WAFIRA). The programmes were delivered jointly in partnership with the African Gong - Pan-African Network for the Popularization of Science & Technology and Science Communication in Africa. House of Science also supported three DSI initiatives: hosting one of the World Science Forum 2022 pre-events; participating in the 2023 National Science Week; and hosting an intern as part of the DSI-HSRC Internship Programme 2023/25.

Flagship Activities

Science Communication Programme

Science communication skills play a pivotal role in nurturing the scientific ecosystem and fostering the professional growth of scientists and academics. These skills wield a transformative influence, positively shaping research outcomes, career advancement, visibility, audience outreach, and the capacity to influence decisions and policies. Regrettably, numerous STEM graduate training programmes in Africa continue to lack comprehensive training in this vital area.

The **Africa Scientifique (AS) programme** is a unique capacity-building programme focused on Afrocentric science communication. It aims to support young and emerging African scientists, researchers, and academics to develop leadership, knowledge, and skills necessary for impactful science communication. The programme has been successfully delivered annually to the cohort of AIMS South Africa Master's students since 2020. The AS programme has been tailor-made to address students' critical needs to become well-rounded mathematical scientists and effective communicators across the African continent.

The programme is usually delivered in three phases: the AS Introductory Workshop (Phase 1), the three-day AS Workshop (Phase 2) and the six-month Post-Workshop mentoring and project activities (Phase 3). During Phase 1, all students and researchers at AIMS are invited to participate. However, only 35-40 students and researchers are selected to participate in Phase 2 to maximise engagement and learning impact during this phase.



AS 3 day workshop group



AS 3 day workshop

2023 Africa Scientifique Programme Highlights

The 2023 Africa Scientifique programme was delivered face-to-face to the 4th cohort of AIMS South Africa Master's students. Each phase of the programme is described below.

Phase 1 - Introductory Workshop (24 February):

Participants included 55 AIMS students, researchers and teaching assistants. Similar to the 2020-22 AIMS cohorts, the participants indicated that they had never attended any science communication capacity-building training nor undertaken public engagement activity to communicate mathematics. The AS programme was the beginning of a new journey of knowledge, discovery and first-hand experience in science communication.

Phase 2 - The three-day Workshop (8 to 10 May):

40 (48% of whom were female) Master's students participated in the workshop. The three-day workshop covered topics such as (i) the global development of science communication, including drivers of growth, excellence and research relevance; (ii) research dissemination, public engagement and good practice in mathematics outreach activities; (iii) gender and socio-cultural inclusion in science communication; (iv) leadership skills for research, academia and future career progression; (v) presentation and communication skills, both written and oral, utilising various tools, platforms and engagements; science communication formats, platforms and tools: engendering public trust, engagement and audience enrolment and; (vi) panel discussion on mentoring for science communication and engagement.



AS intro workshop

Phase 3 - Six-Month Post-Workshop Support and Project Delivery (June to December 2023): The critical aspect of the AS programme is that students are supported during the six-month Post-Workshop phase when they design, deliver and evaluate their science communication projects. The projects address societal challenges using mathematical science knowledge and research in their communities. Students are encouraged to deliver these projects using African indigenous languages. The projects showcased impressive creativity and were aimed at audiences that are usually neglected, such as security guards, fishermen, farmers in villages, gamblers, unemployed women, African women hairdressers and barbers, young smokers, motorbike riders, marketers, etc.

Here are a few samples of science communication projects from the 2020 and 2021 cohorts of the AS programmes that took place at AIMS South Africa.

Programme Awards:

All attendees of the three-day workshop were awarded certificates. Maitiello Reneilwe Maanaso and Clinton Garayi, both received the prestigious AS Excellence Awards. Their notable improvement in engagement and communication skills, including presentation and proposal writing, set a high standard, inspiring their peers throughout the workshop. These recognitions were coupled with cash prizes generously conferred by African Gong, further motivating excellence in science communication.

Participant Feedback

“

“The content, organisation, and overall delivery of the AS programme were truly exceptional. As a budding data scientist, this workshop was incredibly valuable. Data scientists are expected to present their findings effectively, and this project helped me overcome some of the challenges I faced during presentations. Personally, it has transformed me, instilling the confidence to embrace my identity as an African researcher and celebrate my ability to solve problems.”

Frans Nthite

“

“I initially hesitated to participate in this workshop, thinking I didn't need communication lessons as I had always been communicating effectively. To my surprise, the workshop's content and the innovative presentation of different concepts and techniques were truly enlightening. I now wish this workshop could be a regular skills course at AIMS. The knowledge gained will become a part of my daily routine.”

Emmanuel Kwarirandunda

Added Value Outcomes:

The book chapter on Building Capacity for Science Communication in South Africa: Afrocentric Perspectives From Mathematical Scientists spotlights the Africa Scientifique programme.

The chapter discusses how the programme has the potential to bridge the gaps between the South African government's well-developed policy positions and practical implementation of its scientists' imperative to deliver, through meaningfully resourced mechanisms, a viable, sustainable and impactful science communication agenda. Dr Rejoyce Gavhi-Molefe and Dr Rudzani Nemutudi (affiliation - NRF: iThemba LABS), authored this chapter, which has been included in a newly published book on Race and Sociocultural Inclusion in Science Communication, edited by Dr Elizabeth Rasekoala. The book is part of the Bristol University Press Contemporary Issues in Science Communication series. The series aims to provide multidisciplinary knowledge and practical suggestions for transforming practice in the field. The book featured 30 authors (science communicators, academics, practitioners, researchers and social scientists) from the global North and South.

2023 Africa Scientifique Workshop Contributors

Workshop Programme	Contributors' Name/Professional Category/Affiliation//Year
Introductory remarks	<ul style="list-style-type: none"> • Prof. Ulrich Paquet, Director, AIMS South Africa • Dr Simukai Utete, Academic Director, AIMS South Africa • Ms Joy Nogabe, Assistant Director, Department of Higher Education and Training (DHET) International Scholarships • Dr Elizabeth Rasekoala, President, African Gong • Dr Rejoyce Gavhi-Molefe, Senior Manager, House of Science
Main sessions	<ul style="list-style-type: none"> • Drs Elizabeth Rasekoala and Rejoyce Gavhi-Molefe • Prof. Nokwanda Makunga, Medical Plant Biotechnology Expert, Stellenbosch University • Dr Catherine Ndinda, Research Director, Human Sciences Research Council (HSRC)
Panel discussion & Africa Scientifique Programme Alumni contributions	<ul style="list-style-type: none"> • Dr Clement Nyirenda, Acting Head, Department of Computer Science, University of the Western Cape • Dr Ephifania Geza, Bioinformatician, University of Cape Town • Dr Mesias Alfeus, Senior Lecturer in Financial Risk Management, University of Stellenbosch • Ms Nombali Qodi, Cloud Engineer Intern, Altron, Africa Scientifique programme 2022 Alumni • Ms Thandiwe Dlamini, Mathematics Educator, Mbuluzi High School, Swaziland - Africa Scientifique Programme 2021 Alumni • Ms Everlyn Chimoto & Ms Thembelihle Dlamini, PhD & MSc Students, AIMS South Africa, Africa Scientifique Programme 2021 Alumni • Mr Londani Tshindane, Lecturer, University of Venda, Africa Scientifique programme 2021 Alumni

Alumni Spotlight:

As part of the AS programme, students engage in hands-on learning with peers and guided support, fostering sustained involvement even after formal training.

On 25 May, Joseph Muthui Wacira, a Research Master's student at AIMS and a 2021 AS alumni, represented AIMS at Muizenberg High School's career expo organised by Muizenberg Library. The event, attended by 500+ learners, enabled interactions with various institutions and City of Cape Town departments. AIMS' exhibition featured interactive maths and art activities, presentations, and posters, highlighting AIMS' work, role models, and the practical applications of mathematics. Supported by Dr Gavhi-Molefe, Joseph shared, "Interacting with the staff and students made me nostalgic about my time in high school. This event provided an opportunity for students to learn more about STEM, and it was well received. The reception emphasises the need for such events in South Africa and Africa at large, showcasing the significance of STEM education."



Career Expo

Women in STEM Programme

One of AIMS's central missions, facilitated through House of Science, is to address the gender disparity prevalent in South Africa's scientific and innovation fields. Recognizing that this challenge extends beyond South Africa, the urgency to empower women in academia is evident. Prof. Loyiso Nongxa* noted, "There had been only one NRF A-rated female mathematician since the ratings were introduced in 1983 and fewer than 10 'B-rated' female mathematicians and statisticians," emphasising the need to foreground and empower women in STEM fields. This imperative aligns with the broader goal of fostering an equitable knowledge-based economy and society.

The **Women's Advancement Forum: International Exchanges, Research & Academia (WAFIRA)** is a three-day intensive and interactive programme designed to meet the leadership development, career aspirations, and professional needs of African women in STEM (in academia and research). It has been delivered in different African countries since 2014, impacting over 1,500 African female academics and researchers. In South Africa, the program was delivered to the first cohort of young women researchers and academics in mathematical sciences at the University of the Western Cape (UWC) from 29 to 30 March 2023 as a partnership between AIMS, African Gong, and UWC.

*<https://www.timeslive.co.za/sunday-times-daily/news/2023-07-25-sa-has-a-shortage-of-top-rated-mathematicians-especially-women/>

2023 WAFIRA workshop highlights

Under the theme Advancing African Women in Mathematical Sciences, 27 UWC female postgraduate students in mathematical sciences participated in the workshop. The event received enthusiastic feedback from the attendees and was a successful collaboration, made possible by the strong support and contributions from UWC and AIMS leadership, including Prof. Burtram Fielding, Dean of the UWC Faculty of Science, and Prof. Ulrich Paquet, Director of AIMS South Africa.

During the two-day workshop, participants engaged in hands-on, minds-on, and highly interactive programs. The sessions covered topics such as transformative institutional frameworks and socio-cultural contexts, science communication, essential skills for research and career advancement, international exchanges for advanced study and research, effective presentation and communication skills (both oral and written), successful mentoring strategies, and maintaining work-life balance, time management, and career progression.

The workshop facilitators included:

- Prof. Nox Makunga, a Medical Plant Biotechnology expert at Stellenbosch University
- Dr Zamambo Mkhize, a Lecturer at the University of Cape Town-African Gender Institute
- Dr Omowunmi Isafiade, a Senior Lecturer at UWC
- Dr Elizabeth Rasekoala, President of the African Gong, and Dr Rejoyce Gavhi-Molefe
- Ms Limpho Makapela, student Projects officer, UWC Gender Equity Unit Department





WAFIRA 2023 Participants

Workshop Outcomes and Participant Feedback

Feedback from the workshop participants highlighted more than just academic development; it encompassed their overall experience. The workshop was described as valuable, insightful, empowering, and transformative. Participants found it educational, relevant, engaging, and fun, contributing significantly to their confidence, science communication, presentation skills, and personal growth. It created a **sense of community**, equipping them with tools to excel in research, navigate publications, maintain work-life balance, leverage international opportunities, and foster positive relationships with supervisors and mentors.

Moreover, participants established the WAFIRA club at UWC, extending the workshop's impact and benefits, creating a lasting legacy within the institution.

“I gained insights into challenges, opportunities, and strengths faced by women daily. We explored financial resources, shifted mindsets, and networked with fellow STEM women. Understanding diverse cultural, social, and economic values empowered me. The workshop enhanced my self-affirmation, confidence, and advocacy skills.”

“The workshop comprehensively addressed the issues, hurdles, and difficulties that women encounter in their STEM career journeys. It provided valuable insights on how African women can progress in the field. I realised that I am not alone in facing challenges as a woman in STEM; this struggle is shared by many. Fortunately, I also learned that these challenges can be overcome, giving me hope and determination to pursue my research and postgraduate advancement.” - **Workshop participants**

The goal in South Africa is to annually extend the WAFIRA program nationwide, specifically focusing on historically disadvantaged universities. This initiative aims to enhance the representation of Black African women, particularly in academic and research roles within mathematical sciences, addressing the significant under-representation in leadership positions.

Added Value Enrichment Activities

AIMS Gender in STEM: Mentoring for Social Development & Transformation

Three AIMS Gender in STEM (AIMSGIS): AIMS Women in STEM (AIMSWIS) and Mentoring for Transformative Masculinity (MTM) in-house mentoring events were held for the students (both male and female). The objectives of the AIMSGIS mentoring programme are to:

- Establish a supportive environment where students can receive guidance from empathetic senior peers, acting as role models to help them enhance life skills and boost self-confidence.
- Foster a diverse networking platform connecting students with accomplished STEM professionals, including AIMS alumni.
- Enhance the involvement, advancement, and retention of women and girls in STEM-related fields.

The mentoring sessions showcased six AIMS alumni who shared insights from diverse career paths in academia and industry. Topics included mentoring for social development, navigating AIMS and post-AIMS careers, personal and professional growth in mental health, the significance of nurturing mentoring relationships for career and research progress in mathematical sciences, and achieving work-life balance. These events serve as vital platforms, enriching students with valuable skills to prepare them as well-rounded graduates in academia and industry. Moreover, they contribute to fostering gender inclusion and empowering women in these fields.



The speakers shared their personal experiences, career opportunities and good practice strategies on how students can become resilient and productive during AIMS training and the post-COVID-19 era and ongoing global pressing societal challenges. They also encouraged students to seek help and use the AIMS community and resources available to support them.

2023 National Science Week Launch

House of Science provides support and mentoring to enhance and up-scale AIMS students and researchers in research dissemination and community outreach. In July 2023, Dr Joel Lontsi, a postdoctoral researcher, and Mr Rockefeller, a PhD student, were mentored and supported by Dr Gavhi-Molefe to participate and exhibit at the official Launch of South Africa's 2023 National Science Week (NSW). The Launch was held at the University of Venda in the Limpopo Province on 22 July.

The AIMS exhibit focused on showcasing the contributions of mathematics to the modern world and communication. Dr Lontsi and Mr Rockefeller actively engaged with learners, teachers, and the general public through mind-teasing games, conversations, and Q&A sessions, all centred around the applications of mathematical sciences. NSW is an annual week-long celebration of Science, Technology, and Innovation (STI), organised by the DSI. The 2023 NSW focus week was celebrated nationwide from 31 July to 5 August, with the theme Transforming lives through evidence-based science.



Dr Joel Lontsi at the National Science Week launch



Mr Rockefeller at the National Science Week launch

2022 World Science Forum

On 2 December 2022, AIMS South Africa actively participated in the first-ever World Science Forum (WSF) held in Cape Town under the theme "Science for Social Justice." AIMS hosted a dialogue on "Advancing mathematical sciences and research for societal development in Africa," allowing delegates to learn about AIMS and engage in dynamic discussions. This event was especially valuable for AIMS students and researchers, providing exposure to diverse engagement platforms, mentors, and networking opportunities.

Dr Gavhi-Molefe moderated the first panel discussion, focusing on Science for Africa, exploring themes of social justice, transformation, and sustainable development. The discussion emphasised AIMS's use of pan-African leadership and partnerships in academic, research, and public engagement. Panellists included Dr Simo Mthethwa, a Mathematician at the University of KwaZulu-Natal, Mr Lusani Mulaudzi, a Healthcare Actuary, Independent Non-Executive Director and Lecturer at UCT and Dr Elizabeth Rasekoala, President of African Gong.

The second panel discussion was moderated by Ms Ashleigh Basel, an AIMS South Africa researcher. The focus was on

Strengthening research, excellence and impact at AIMS, which highlighted mathematical sciences research conducted at AIMS and its impact on the continent. Panellists included Mr Mmatlou Kubyana, a PhD student in BioMathematics at SU; Dr Emmanuel Dufourq, a lecturer at SU and the AIMS-Canada Junior Research Chair in Data Science for Climate Resilience, Dr Inès Mbonda, a Postdoctoral Researcher at AIMS South Africa; and Dr Bubacarr Bah, a German Research Chair of Mathematics with specialisation in Data Science at AIMS South Africa.

Ms Mmampei Chaba, Director of DSI Africa Multilateral Cooperation, lauded AIMS's contribution to WSF 2022. She commended the collaboration between AIMS and DSI, recognising AIMS's outstanding work in postgraduate training, world-class research, and promoting women's advancement in mathematics.

As a part of AIMS' involvement in the WSF, Dr Gavhi-Molefe attended its launch, organised by DSI at the Iziko South African Museum on 10 November 2022. Additionally, she actively participated in WSF's pre-events, including the German and South African Public Engagement Exchange Training Workshop and Senior Roundtable, held from 1 to 2 December and on 5 December, respectively.



World Science Forum Delegates

Stakeholder Engagement

Visitors to AIMS South Africa

On 8 August 2022 a delegation from the Japanese Ministry of Economy, Trade and Industry visited AIMS South Africa to discuss possible student internships. They met with Dr Utete, Prof. Green and Dr Gavhi-Molefe.



Japanese Delegation visit

On 8 September a German delegation visited AIMS South Africa. The delegation consisted of Erik Hansalek, Head of section "Cooperation with Africa and the Middle East", Federal Ministry of Education and Research (BMBF); Hartmut Stalb Head of Section " Research and Innovation, Coordination of the Research Area", Federal Ministry of Food and Agriculture (BMEL); Nina von Sartori, Policy Officer for southern Africa, Federal Ministry of Education and Research (BMBF); Maja Clausen, Research and Innovation Officer, Federal Ministry of Food and Agriculture (BMEL); Maximilian Berger, Agricultural Attaché, German Embassy Pretoria; Christoph Hansert, Head of Division Development Cooperation and Transregional Programmes, German Academic Exchange Service (DAAD); Nina Akrami Flores, Senior Desk Officer, Section Development

Cooperation, German Academic Exchange Service (DAAD); Ruth Knoblich DAAD lecturer and researcher at the South African-German Centre for Development Research, University of the Western Cape; Shamiso Mandioma DAAD Project Coordinator, University of the Western Cape; and Dr Andreas Kunzmann Senior Scientist, Leibniz Centre for Tropical Marine Research (ZMT). The delegation went on a tour of the facilities and then had an introductory meeting with Prof. Green, Dr Gavhi-Molefe, Dr Attipoe and Dr Ranirina. Mr Christoph Hansert, then gave a presentation on the concept of the new African-German Centre of Excellence for Food Systems and Applied Data Science. This was followed by a presentation about the Data Science Research Group in the AIMS Research Centre given by Dr Ranirina.



German Delegation visit

On 5 December Prof. Motoko Kotani, Tohoku University, together with Mr Takejiro Yamada, Embassy of Japan in South Africa, visited AIMS South Africa. They met with Prof. Green and Dr Gavhi-Molefe and Prof. Loyiso Nongxa, a member of the AIMS Trust.



Prof. Kotani and Mr Yamada visit

On 12 January 2023 Prof. John Shawe-Taylor, UNESCO Chair in AI, Professor of Computational. Statistics and Machine Learning, University College London,



Prof. Shaw-Taylor visit

On 26 January 2023 representatives from the Government of Canada: Dr Nipun Vats, Assistant Deputy Minister, Science and Research Sector, Science and Economic Development Canada, Ms Kate Raspopow, Manager, Science Policy Branch, Science and Research Sector, Innovation, Science and Economic Development Canada and Ms Vijayata Senior Policy Analyst, Science Policy Branch Innovation, Science and Economic Development Canada visited AIMS. They were joined by representatives from the South African Department of Science and Innovation: Mr Cecil Masoka, Director: Overseas Bilateral Cooperation (Americas and Asia); Mr Kagiso Moloto, Assistant Director: Overseas bilateral Cooperation (Americas and Asia); and Ms Kediemetse Mnsi, Overseas Bilateral Cooperation, Admin support. The delegation met with Prof. Paquet; Dr Utete, Dr Dufourq, Dr Rejoyce Gavhi- Molefe. Prof. Neil Turok, Chair, AIMS International Governing Board joined the meeting online.



Canadian and DSI delegation visit

On 24 May 2023, Sabrina Ouellet, Program Specialist, Relations with Universities, Universities Canada and Pascale Bédard, Colleges and Institutes Canada & Universities Canada Consortium, Manager of Operations, Canadian International Development Scholarships 2030, had a meeting with Prof. Ulrich Paquet, Dr Simukai Utete, Dr Rejoyce Gavhi-Molefe and Mrs Lynne Texeira to discuss potential opportunities with AIMS South Africa.



Canadian delegation visit

Meetings Attended

Prof. Barry Green attended the DSI-NRF-CNRS Workshop on Research for Impact: Strengthening Scientific collaboration between Europe and Africa, held from 17 to 20 October 2022. The Mathematics theme was led by Prof. Sophie Dabo and Prof. Green, and included a group of mathematicians from France, and Africa, including South Africa. AIMS Council Member, Prof. Loyiso Nongxa, also attended.

Prof. Green, who is a standing member of the German Research Chairs Scientific Panel, also attended public lectures and interviews for a German Research Chair which were held at the AIMS Senegal Campus from 23 to 26 October 2022.

Governance and Administration

Trust

The AIMS Trust meeting was held on 8 March 2023. In attendance were Dr Rob Adam, Prof. Loyiso Nongxa, Prof. Neil Turok (Chair), Ms Nasima Badsha, Prof. Fritz Hahne, and Prof. Daya Reddy. They were joined by Prof. Ulrich Paquet and Ms Lynne Teixeira.



Council

The AIMS South Africa Council meeting took place on 8 March 2023. Members who attended the meeting were: Prof. Daya Reddy (University of Cape Town) Chair; Prof. Ulrich Paquet (Director, AIMS, ex-officio member); Prof. David Holgate (University of the Western Cape); Prof. Mike Giles (Oxford University); Prof. Stéphane Ouvry (Université Paris Saclay); Prof. Neil Turok (Edinburgh University); Prof. Louise Warnich (Stellenbosch University) and Prof. Grae Worster (Cambridge University). Prof. Thandi Mgwebi (Nelson Mandela Metropolitan University) was absent.

Prof. Stéphane Ouvry resigned from the Council in March 2023.



Staff

In the period under review AIMS South Africa said farewell to Prof. Barry Green. Prof. Green retired as Director of AIMS South Africa in December 2022, after 12 years.



In January 2023 AIMS South Africa welcomed its new director, Prof. Ulrich Paquet. Prof. Paquet is a South African artificial intelligence and machine learning veteran with over 20 years experience. He is the co-founder of The Deep Learning Indaba, an organisation whose mission is to strengthen machine learning in Africa. Prof. Paquet moved to South Africa with his family and has a five-year term at AIMS South Africa with a dual appointment at DeepMind.

Prof. Paquet is assisted by the Management Team consisting of Dr Barrie Barnard (AIMSSEC Manager), Ms Linda Camara (Communications Manager), Mr Jan Groenewald (IT Manager), Mr Igsaan Kamalie (Facilities and Logistics Manager), Dr Rejoyce Gavhi-Molefe (House of Science Manager), and Dr Simukai Utete (Academic Directors).

In April 2023, Dr Emmanuel Dufourq, the former AIMS Canadian Junior Research Chair in Climate Science was appointed as a Resident Researcher in the AIMS Research Centre. He is heading up the Machine Learning for Ecology Group at the centre.

Information Technology

During 2022-23, the AIMS South Africa IT department remained steadfast in supporting hybrid teaching and video conferencing. However, challenges arose due to increased load shedding and generator faults, causing disruptions in equipment functionality. To address these issues, plans for widespread equipment replacement in 2023-24 are underway, within the confines of the available budget.

Notably, the 2022-23 graduation live stream faced interruptions caused by power cuts. To mitigate such disruptions in the future, we are actively exploring the installation of a new generator and uninterruptible power supply (UPS) systems.

Additionally, our efforts to enhance research capabilities have seen a slow yet steady growth in the usage of AIMS High-Performance Computing (HPC) facilities hosted at Stellenbosch University and CHPC. We are facilitating access for new researchers and anticipate further expansion, including the utilisation of cloud compute capabilities such as the Google Compute Platform for GPU programming.

Furthermore, to accommodate the anticipated increase in student and tutor numbers in 2023-24, we have upgraded our file server disks from spinning magnetic disks to solid-state disks. This upgrade has significantly enhanced performance in campus labs, enabling faster completion of several file server maintenance tasks, reducing processing times from days to hours.

In response to the dissolution of the Next Einstein initiative, we are collaborating closely with IT teams at other AIMS centres to ensure a consistent IT experience for students, tutors, and lecturers.

Our commitment to education remains unwavering. Classes covering essential topics such as Computing and LaTeX, AIMS Desktop usage, online collaboration tools, revision control, and related computing subjects continue to be offered, ensuring that our community remains proficient in crucial technological skills.

Communications Report

We are pleased to report the continued growth of the AIMS South Africa YouTube channel, which boasts a steady increase in subscribers, reaching a current total of 16,283. Over the period from August 2022 to July 2023, our channel received a total of 175,818 views. Our audience primarily comprises individuals aged 18-24 (44.4%) and 25-34 (37.4%), mirroring the statistics from the previous year with slight variations. Geographically, the majority of our viewers are located in the United States (15.4%) and India (13.4%).

In contrast to our YouTube channel, our Facebook and Instagram pages are making significant strides in reaching a diverse African population. Our Twitter account has garnered 3,846 followers, while our Facebook page boasts 5,905 followers and 5,400 likes. On Instagram, we currently have 612 followers.

We are particularly proud of the positive reception of our free and accessible AIMS Courses on YouTube, which continue to receive high viewership and positive feedback.

Additionally, our communication efforts have extended beyond social media. Regular newsletters are being distributed in an improved HTML format, well-received by our audience. Furthermore, we have developed various marketing materials, including posters, websites, and certificates, to support our workshops, events, and online activities.

It's worth noting that our outreach initiatives are not solely measured by numbers; they reflect our commitment to inclusivity. We are actively working to increase the representation of women within AIMS South Africa, and we are dedicated to expanding our impact across the African continent.

Financial Report 2022 - 2023

Total Income Analysis

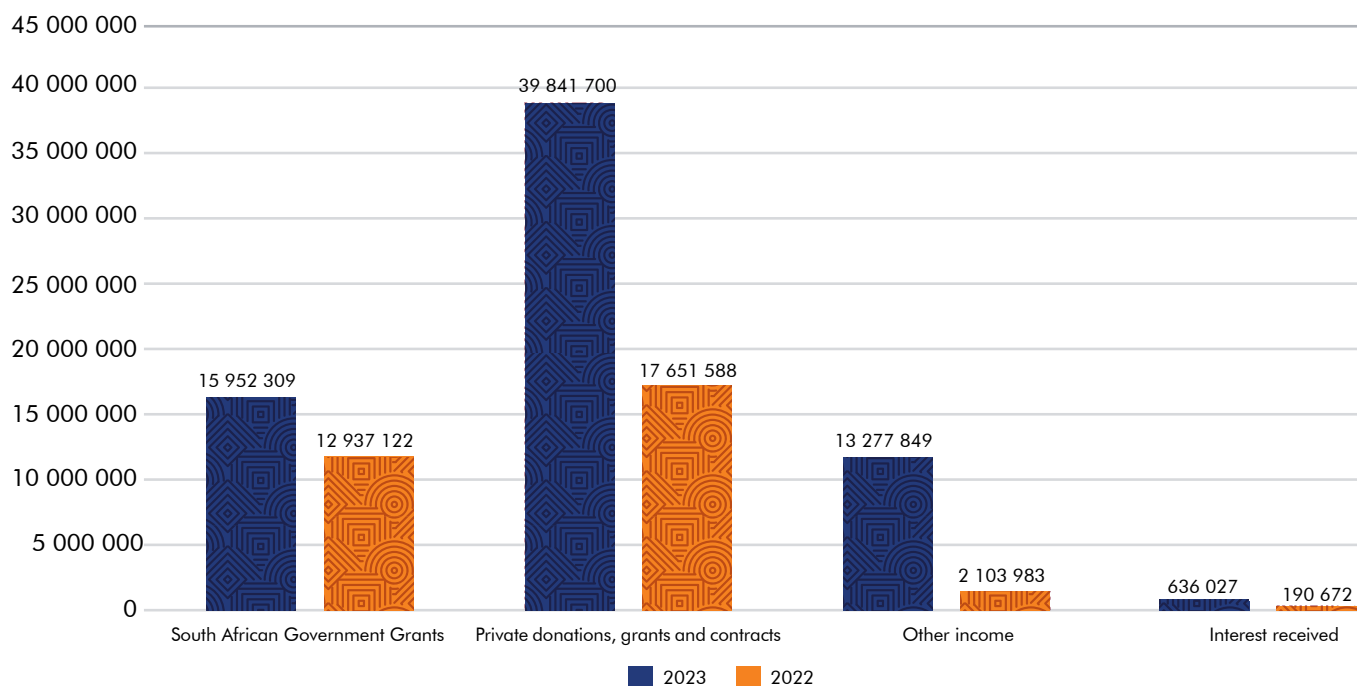


Figure 1. Total income per main component (Rand)

Overview

Comparatively, total income increased by 112%. This increase can be explained by:

- i) the Google DeepMind scholarship (2023-24 AI for Science Master's Programme)
- ii) clearing of historic debt, listed as Other Income (see Other Income section below)

South African Government Grants

South African Government grants is showing an increase of R3 million (23%) which is mainly due to:

- i) the grant received from the National Skills Fund (R2.6 million)
- ii) increase in the grant from the Department of Higher Education and Training (R275,000)
- iii) increase in the grant from the National Research Foundation (R112,000)

Private Donations, Grants And Contracts

The increase in private donations, grants and contracts is mainly attributable to the Google DeepMind scholarship funding. The grant was awarded over a 4 year funding cycle. The funding for year 1 was transferred during the current financial year to the value of US \$1,021,440 (ZAR 18,918,907).

Other Income

Until 30 June 2022, AIMS South Africa's cost centre at Stellenbosch University carried a debt of R5 million that belonged to AIMS Next Einstein Initiative (AIMS NEI) in Rwanda. This debt was correctly transferred to its owner, AIMS NEI, and is recorded as other income in AIMS South Africa's financial statements. Stellenbosch University took over an additional R6 million of historic debt, which is also recorded as other income.

Interest Received

A separate bank account was opened to ringfence the Google DeepMind scholarship funding and interest is earned in this account which is the main reason for the increase in interest earned

Breakdown of South African Grants for the 2023 and 2022 financial years are as follows:

Department	Programme	2023	2022
Department of Higher Education and Training	Academic Programme	R 7 143 000	R 6 868 000
Department of Science and Innovation	Academic Programme, Research Programme and Post AIMS bursaries	R 1 035 000	R 1 035 000
National Skills Fund	AIMSSEC Teacher Training Programme and MSc bursaries	R 2 628 718	R -
National Research Foundation	Research Programme	R 5 145 591	R 5 035 122
TOTAL SOUTH AFRICAN GOVERNMENT GRANTS		R 15 952 309	R 12 938 122

Breakdown of private donations, grants and contracts for the 2023 and 2022 financial years are as follows:

Department	Programme	2023	2022
Mastercard Foundation	Taught Masters Programme, Siyakhula Festival, Renovations Project	R 13 653 430	R 7 475 726
The Alexander von Humboldt Foundation	German Research Chairs	R 368 448	R 2 093 638
DAAD	Bursaries / Scholarships	R -	R 172 623
Google DeepMind	AI bursaries	R 22 986 273	R -
Other Private Donations	Taught Masters Programme, ESMT, DSI and Teacher Training Programme	R 2 833 549	R 7 909 601
TOTAL PRIVATE DONATIONS, GRANTS AND CONTRACTS		R 39 841 700	R 17 651 588

Total Expenses Analysis

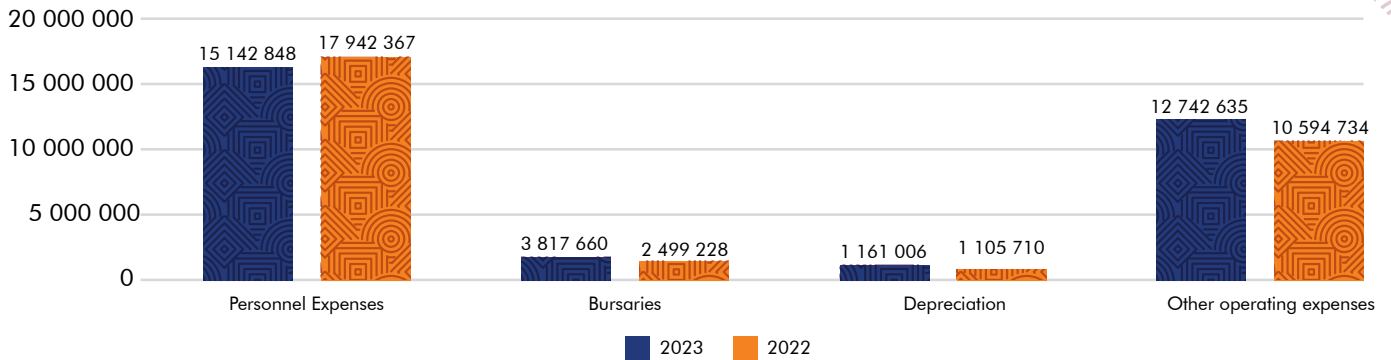


Figure 2. Total expenses per main component (Rand)

Comparatively, total expenses is showing a marginal increase of 2% which is mainly attributable to increases in day-to-day operational expenditure. Bursaries comprises bursaries to AIMS Research Centre students, NSF bursaries and post AIMS bursary recipients. Other operating expenditure includes all costs relating to the Taught Masters Programme and the AI Programme. Expenditure is monitored carefully, within the prescribed limits as determined by funder requirements and regulations.

Breakdown of total expenses per main component

EXPENSES	2023	2022
Personnel expense	R 15 142 848	R 17 942 367
Bursaries	R 3 817 660	R 2 499 228
Depreciation	R 1 161 006	R 1 105 710
Other operating expenses	R 12 742 635	R 10 594 734
TOTAL EXPENSES	R 32 864 149	R 32 142 039

African Institute For Mathematical Sciences - South Africa
Consolidated statement of financial position at 30 June 2023

	2023	2022
	R	R
ASSETS		
NON-CURRENT ASSETS	31 431 952	28 386 070
Property, plant and equipment	26 724 082	24 104 580
Intangible Assets	1	1
Financial Assets	4 707 869	4 281 489
CURRENT ASSETS	48 849 723	2 430 744
Cash and cash equivalents	39 625 815	1 167 918
Trade and other receivables	2 168 881	1 216 023
Inventory	97 179	46 803
Stellenbosch University receivable	6 957 848	-
TOTAL ASSETS	80 281 675	30 816 814
FUNDS AND LIABILITIES		
FUNDS AND RESERVES	57 817 596	20 582 487
Accumulated funds	52 889 541	16 174 240
Restricted reserve: endowment fund	2 188 455	2 153 447
Restricted reserve: other	197 427	104 000
Fair value reserve	2 542 173	2 150 800
CURRENT LIABILITIES	22 464 079	10 234 327
Stellenbosch University payable	-	6 299 976
Trade and other payables	22 464 079	3 934 351
TOTAL FUNDS AND LIABILITIES	80 281 675	30 816 814

African Institute for Mathematical Sciences - South Africa
Consolidated Statement of Comprehensive Income for the year ended 30 June 2023

	2023	2022
	R	R
Government grants	15 952 309	12 937 122
Donations Income	39 841 700	17 651 588
Other income	13 277 259	1 434 584
Profit on sale of fixed assets	590	669 399
Gross Income	69 071 858	32 692 693
Operating expenses	(32 864 149)	(32 142 039)
Operating surplus	36 207 709	550 654
Finance income	636 027	190 673
Surplus for the year	36 843 736	741 327

Other comprehensive income:		
Item that may be subsequently reclassified to profit or loss		
Change in value of available-for-sale financial assets	391 372	1 413
Total comprehensive surplus for the year	37 235 108	742 740

Supporters for period under review.

AIMS South Africa Donors and Supporters

AIMS Endowed Scholarships contributors

- Avery Tsui Foundation
- Neil Turok
- Paul G Allen Family Foundation
- Peter Kellner

Alexander von Humboldt Foundation (AvH)

DST-NRF CoE in Mathematical and Statistical Sciences (CoE-MaSS)

Austrian Embassy Pretoria

German Academic Exchange Service (DAAD)

German Federal Ministry of Education and Research (BMBF)

Google DeepMind

Mastercard Foundation

Pan-African Network for the Popularization of Science & Technology and Science Communication (AFRICAN GONG)

Government of South Africa:

- Department of Higher Education and Training (DHET)
- Department of Science and Innovation (DST)
- National Research Foundation (NRF)

ETDP SETA

The Mastercard Foundation Scholars Program

Stellenbosch University

Université Paris-Sud XI

University of Cambridge

University of Cape Town

University of Oxford

University of the Western Cape

University of Leeds

Baden-Württemberg Stiftung

University of Heidelberg

AIMS South Africa would like to thank the following lecturers for donating their honoraria or a portion thereof to AIMS in this period:

Mike Giles

Jan Hazta

Dugald MacPherson

Paul Taylor

Richard Katz

Timothy O'Brien

Grae Worster

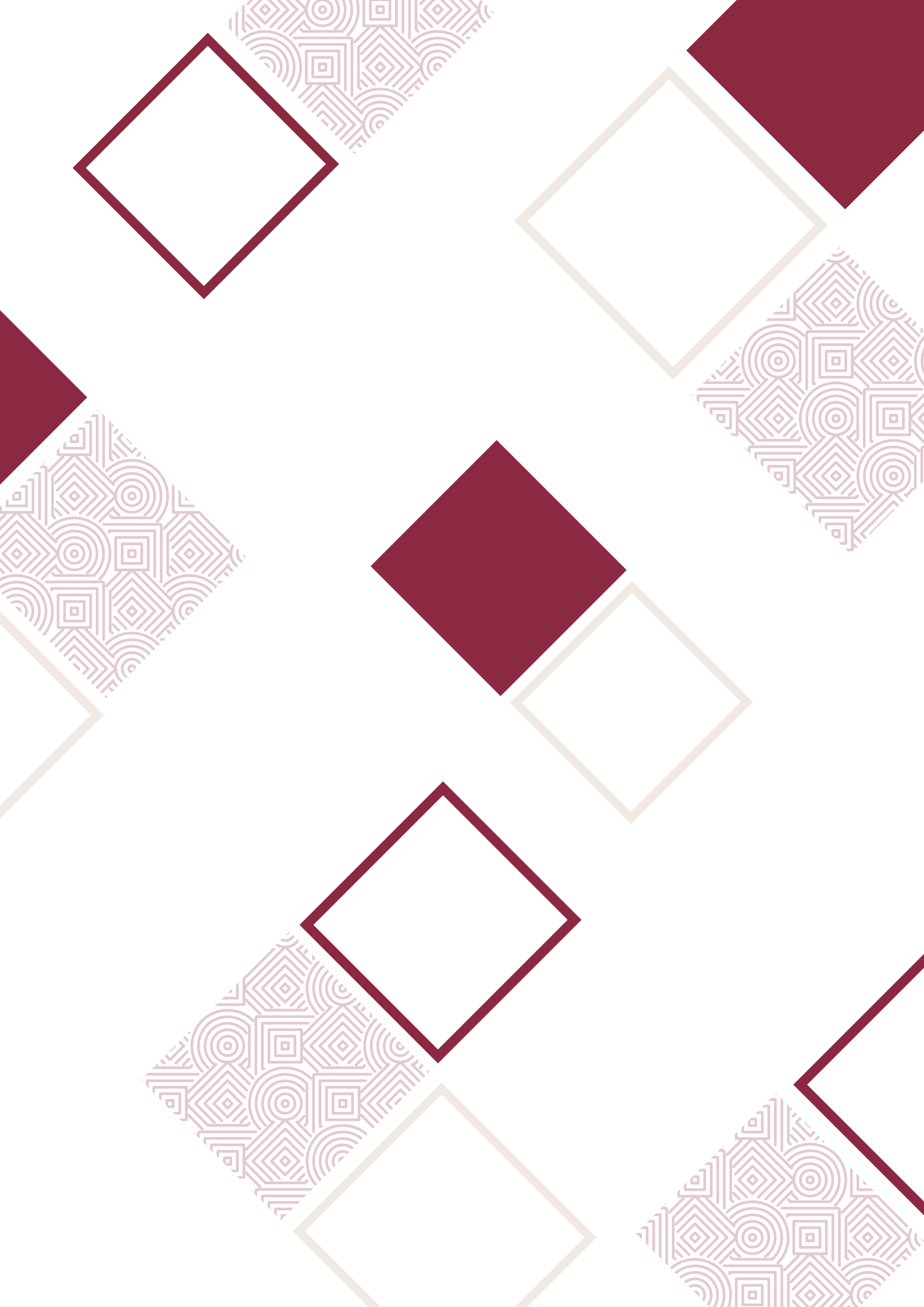
AIMSSEC is grateful to its sponsors for supporting its programmes for this reporting period.

Government of South Africa DHET through the National Skills Fund

Old Mutual Foundation through the South African Mathematics Foundation

Standard Bank through the South African Mathematics Foundation

Oppenheimer Memorial Trust





AIMS

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