

NSTF-South32 Awards

Transforming South African mines into 'zero-harm tolerance' zones for all workers

TW Kambule-NSTF Award: Researcher

Sumiya Ismail

To adequately address the working conditions in the South African mining sector is to pursue safety over profiteering. For many years, improvements have been phased in through scientific projects executed by Professor Lindiwe Zungu, executive dean of graduate studies at Unisa, with the support of the Mining Health and Safety Council.

Zungu has developed a comprehensive set of guidelines to assist the South African mining industry to better cater to the needs of female miners. As a result of her research, the industry implemented new protective gear, designed specifically for women working underground.

"The mining industry is a male-dominated sector and all equipment and clothing were designed along the male physique," she says. "The risks for female

miners in particular are concerning, where everything from toxic inhalations of underground gases to unwanted sexual advances in the workplace are a daily reality."

Zungu, an award-winning research expert in the medical field, is determined to champion change in the South African mining industry to ensure that women make it back to their homes and families safely at the end of each working day. As such, sustainability, safety, profitability and empowerment are major priorities in Zungu's scientific endeavours.

"Female empowerment in the workplace has been a major focus in the work I have done throughout my career, and I believe that better health and safety policies and codes of practice in male-dominated industries like mining will help in achieving this," says Zungu.

"The mining industry is a risky environment as it is, but women in mining face much more difficult conditions on the job. The goal is to transform the mining environment into one that better considers and provides for the wellbeing of women, taking into account their unique needs that differ to that of males in the workplace."

In 2011, she facilitated a project for the Mining Health and Safety Council that dealt with Post Traumatic Stress Disorder (PTSD) in the South African mining industry. This culminated in the development of safety codes and policies that encourage interventions for early diagnosis and appropriate management of PTSD for mine workers.

Monique Verduyn

Algorithms are shaping the way we live. At its most simple, an algorithm is a step-by-step process for solving a problem. Some are everyday problems, others are more complex.

Let's say you want to buy a car and you have two objectives in mind: comfort and affordability. The more comfortable a vehicle, the higher the cost, and therein lies the conflict between the two goals. Here's a trickier example: how can you cost electricity in a way that guides responsible behaviour on the part of users, yet still make a profit? In a manufacturing plant, how can you drive up profits while also meeting clients' tight deadlines? This is where algorithms can help.

When Dr Mardé Helbig, senior lecturer in the department of computer science at the University of Pretoria, found that little work had been done on solving problems with conflicting objectives that change over time, known as dynamic multi-objective optimisation problems (DMOOPs), she began to focus on solving DMOOPs using vector-evaluated particle swarm optimisation. These are algorithms which are simulated or inspired by biological behaviours of animal or birds and have been used to find the optimal solution to a given problem.

"Many real world optimisation problems are dynamic," says Helbig. "They have more than one objective, with at least two of those objectives in conflict with one another, and at least one objective or constraint changing over time," she says. "Research in this area can be applied to optimising the treatment of water based on what it's going to be used for: the scheduling of jobs at a production plant or the routing of vehicles, for example."

The main goals of her research were to develop an algorithm that can solve DMOOPs efficiently, work out how to measure whether an algorithm can solve DMOOPs competently, and to set benchmarks for their development

Optimising algorithms to enhance decision-making

TW Kambule-NSTF Award: Emerging Researcher

and evaluation.

The benchmark suite characteristics, performance measures and approach to compare the performance of various algorithms when solving DMOOPs has provided the DMOO community with a platform for the evaluation and standardisation of newly proposed algorithms.

"It's about a new way to compare algorithms that determines which one is better, and finding ways to adapt them when changes occur, which they are bound to," she says of her ground-breaking research that led to her election as a member of the South African Young Academy of Science (Sayas) in 2017 and as a member of the executive committee of Sayas in 2017 and 2018.

