

MINING VIRTUALLY

(How to go underground in a mine without going underground)

University of Pretoria

Since opening in 2015, Africa's very first virtual reality (VR) training centre, housed at the University of Pretoria, has gone from strength to strength, preparing mining students safely above ground, for what they will be facing below.

Imagine being able to explore a mine without even setting foot outdoors. Imagine going down a mine shaft to explore the rock formations below the surface of the earth without moving from ground level. Imagine being able to practise

blasting a rock face into pieces to uncover the ore it contains with no more than a modified digital pointer in your hands. In the past, this might have been considered a fantasy, but today it is a reality – a virtual reality!



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The University of Pretoria's Department of Mining Engineering embraced the idea of a virtual reality (VR) training centre in 2013 after its Head of Department, Prof. Ronny Webber-Youngman, had seen a similar facility at an Australian university. Recognising the potential of such a facility for the teaching of mining engineering, he pitched the idea to industry, and with the financial support of Kumba Iron Ore, a dream started to come to life.

Virtual roots

Upon its establishment in 2015, it became the first centre of its kind to be housed at an African university – and

only the second in the southern hemisphere – that could provide safe training to students and mine staff in a simulated mining environment. It consists of floor-to-ceiling screens on which a VR simulator casts 360° 3D images with cinematic clarity and highly realistic sound effects.

The VR centre is a key component of the Department's vision of "education and leading mining engineers to become imagineers". All first-year mining engineering students have their first exposure to the VR theatre within their first week of classes.

It takes them on a virtual tour of a mine, with all its earth-moving equipment and gigantic vehicles, and transports them underground through the various levels of a mine shaft. For many of these students, this is their first exposure to virtual reality, and their reaction is invariably a unanimous "Wow!"

Immersive teaching

During the course of the undergraduate programme, the VR centre is used to illustrate many concepts of mining engineering that are easier to understand in an immersive space.

Postgraduate student Sphehile Buthelezi recalls his first experience in the VR centre: "This was really a Eureka moment for me. Later, it provided me with a much clearer picture of the theory by being able to see the various elements that the lecturer was explaining in 3D."

Senior lecturer Jannie Maritz, who heads the VR centre, explains that the centre serves as a state-of-the-art teaching tool that not only introduces students to a surface or underground mine for the first time, but can be used by industry to safely explain various mining methods to their staff members, eliminating the need to take them underground.

The immersive learning opportunities that are presented in the VR centre allow students to participate more actively in the learning experience and influence the outcomes. It also provides the opportunity for instantaneous evaluation.

A virtual blast!

Students in the third- and final-year Rock-breaking and Rock Engineering and Strata Control modules make use of the centre's VR technology to practise – and be assessed on – their ability to successfully engage in rock-blasting activities. This is an essential skill for a prospective mining engineer.

During this practical exercise, students make use of a VR blast training wall to plan and execute the blasting of a rock face in a controlled and safe environment. By means of mixed reality, they design the blast pattern, mark the blast holes and time the firing sequence of the blast hole, and virtually execute the blast, ultimately experiencing the "explosion" on an interactive screen.



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"This has the advantage over teaching in a traditional classroom environment," explains Maritz "as the learners are able to visualise and fully comprehend the concepts being taught, while gaining practical experience in a user-friendly, safe and erasable environment, where mistakes can be made without any consequences". The students' assessment in this practical exercise is based on the accuracy of their blast design, as well as their speed in marking and timing their designs.

The VR blast training wall can also be used to train newly appointed mine workers to effectively master the skills of marking and timing blast rounds in a controlled and "real" environment. According to Prof. Webber-Youngman, it is the perfect tool to give workers refresher training at regular intervals, thereby enhancing their skills, and improving the quality of the tasks that need to be performed underground for safe and efficient blast outcomes.

Real virtual possibilities

As a learning tool, this kind of immersive training can be used in other industries as well, particularly in cases where the real production environment is expensive or inaccessible, and where mistakes made in the course of training have associated safety concerns.

If you are thinking that you need to enroll in a programme in mining engineering to be exposed to this mind-boggling experience, never fear! The Department offers a two-day Introduction to Mining short course to industry, which includes a session in the VR centre. It is also open to learners who are contemplating a career in mining engineering, and would like to obtain a general idea of what a career in mining entails.

The Department also accommodates school groups – upon request – who are interested in science and technology, and would like to go underground in a mine – without going underground!

Article written by Janine Smit on behalf of the University of Pretoria's Department of Mining Engineering. For more information, go to <https://www.up.ac.za/mining-engineering>.