



MINING SKILLS 4.0


INNOVATIONS IN TRAINING

TECHNOLOGY SCOUTING REPORT

July 2021



MINERALS COUNCIL
SOUTH AFRICA

In partnership with 

Tech-driven training solutions can assist the mining industry in achieving Zero Harm Production and assist Modernisation

Training and skills development in the mining industry have, in the past, been driven by compliance with limited insight into effectiveness. Addressing this has been identified by industry leaders as a key priority toward its Zero Harm target. Emanating from CEO Heartfelt Conversations, and as part of its Khumbul'ekhaya initiative on health and safety, the CEO Zero Harm Forum mandated a focus on training and how it can embed Safe and Healthy practices to achieve **Zero Harm Production**. In addition, a recent in-depth report on 4IR in the Mining Industry predicted that the adoption of digital technology is set to play a major role in reaching Zero Harm Production.

Key definitions:

Zero Harm Production

Zero Harm, the target that every mineworker returns from work, unharmed, every day, does not occur in a vacuum. It goes hand in hand with **production** for a sustainable industry.

Ed-Tech

A blend of the phrase “education technology”, Ed-Tech (or Edu-Tech) refers to the combination of IT tools and educational practices aimed at facilitating and enhancing learning.

What are the drivers and benefits of the adoption of tech-driven training solutions in mining?

Drivers

- **High costs of delivery:** The need to reduce costs of training for sustainable operations (while maintaining/improving effectiveness of training outcomes).
- **COVID-19:** Restrictions and protective measures have led to a push to deliver training with remote modalities across all industries.
- **Accounting for different ways of learning:** The need to account for different users' ways of understanding and remembering key information is leading to exploring new ways of training which can accommodate different cognitive styles.
- **Learners driving adoption of technology:** As the workforce uses more technology in daily life (e.g., smartphones and social apps), there is an increased desire to receive training in ways more suited to the learner's lifestyle.
- **Artificial intelligence:** Data and technology enabled training can be utilised for real-time information gathering and swift insight development based on learner engagement and interaction analysis.
- **Education challenges:** Given challenges in educational attainment, and literacy in South Africa, innovative ways of embedding learning at all ages is critical.

Benefits

- **Cost-reduction:** Through the utilisation of training technologies there is a reduced reliance on manual resources, coupled with increased flexibility and scalability which allows for the potential to automate certain administrative tasks.
- **Remote access modalities:** Training can now be accessed, and effectively delivered from any location.
- **Simply represented complex information:** The correct technology application could allow for complex concepts to be explained in a simple, relatable manner with the assistance of visual cues.
- **Trainee satisfaction:** The interactivity of technology allows training to be more enjoyable and increases motivation to learn.
- **Improved Monitoring, Evaluating & Learning capabilities:** Through the data gathering and analysis features usually possible through the right technology.
- **Development of digital literacy:** Through exposure to technology in training, trainees are simultaneously becoming more digitally literate.

Among the top Ed-Tech trends, immersive and device based learning technologies show potential to improve Zero Harm production outcomes

The five technologies highlighted below, when combined with the correct learning approaches, have the potential to significantly improve Zero Harm production outcomes if they are correctly used to solve **specific problems**:

TECHNOLOGY		DESCRIPTION	ZERO HARM PRODUCTION BENEFITS
IMMERSIVE LEARNING Technology which immerses user in an environment partially or wholly virtual	Virtual Reality	<ul style="list-style-type: none"> A computer-generated simulation of a 3D image or environment that can be interacted with a 'real' or physical way by using special electronic equipment such as a helmet with a screen inside or gloves fitted with sensors Allows for the complete immersion experience that shuts out the physical world, through the wearing of special equipment or immersion in a virtual environment 	<ul style="list-style-type: none"> Ability to fully immerse individuals in 'high-risk' scenarios and prepare them for similar situations in the production environment Display safety information as meaningful and engaging content
	Augmented Reality	<ul style="list-style-type: none"> A technology that super-imposes a computer-generated image on a user's view of the real world to create an interactive experience, often using a smartphone or glasses An enhancement of reality using virtual components 	<ul style="list-style-type: none"> Allows virtual elements, such as safety hazards, to be overlaid onto the real world Key information such as safety distances, and mechanical information can be displayed on and around equipment as knowledge prompts and reminders
	Mixed Reality	<ul style="list-style-type: none"> Combining virtual aspects with real world aspects to produce new environments and visualizations where physical and digital objects co-exist in real time A 'hybrid' of augmented reality and virtual reality 	<ul style="list-style-type: none"> Allows employees the ability to interact with real-life elements such as a control panel, in a virtual environment to enhance understanding of machinery and possible high-risk scenarios they may experience, and how best to handle them in a virtual environment
DEVICE BASED LEARNING Technology used to contain and deliver training content, without immersion	eLearning	<ul style="list-style-type: none"> A structured learning course / experience delivered electronically often through the utilization of a non-mobile device such as a computer / laptop Designed to be accessed from a desk 	<ul style="list-style-type: none"> Assists in conveying complex concepts in a visual manner by building in-depth knowledge on a subject Can leverage media, videos and game-based or interactive techniques to improve learner satisfaction and memory retention
	mLearning	<ul style="list-style-type: none"> Training conducted using a portable computing device such as a smartphone or tablet to make learning more convenient for users Designed to be accessed from anywhere at any time 	<ul style="list-style-type: none"> Improves knowledge retention Highly effective at quick knowledge distribution and micro-lessons Offers flexibility and allows for self-paced learning depending on the individual's cognitive capacities

Sources: Desktop research, stakeholder engagement, RIIS team analysis.

For the technology to have the right impact, it needs to be underpinned by sturdy cognitive-based methodologies

In order to maximize the impact technologies can have on Zero Harm Production outcomes, a range of innovative learning approaches should be applied depending on the specific working environment and its associated challenges. These approaches often take different ways of learning into account utilising cognitive and behavioural sciences to enhance effective learning and understanding.

Some of the innovative shifts in learning practices that can be applied across a range of cutting-edge technologies include:

LEARNING APPROACH	DESCRIPTION	TECHNOLOGIES IT CAN BE APPLIED TO	HEALTHY AND SAFE PRODUCTION BENEFITS
Micro-learning	<ul style="list-style-type: none"> • Taking small “bite-sized” learning content or information steadily fed through the right channel (e.g., mobile) • Allows knowledge gaps to be filled with fun personalized training in 3-5 minutes lessons • Easily measurable impact of implementation based on tracking and testing the user in each micro-module 	<ul style="list-style-type: none"> • AR • mLearning* 	<ul style="list-style-type: none"> • Improves knowledge retention • More cost efficient and requires less time • Offers flexibility and allows for self-paced learning depending on the individual's cognitive capacities • Turns learning into a more habitual, organic experience to assist in behavioural reinforcement
Gamification	<ul style="list-style-type: none"> • Using video game design and/or game elements in a learning environment to maximise the enjoyment and engagement of learners to solve problems and assimilate knowledge • Content can be gamified with, for example, leaderboards and point systems to earn external prizes to engage learners in the process 	<ul style="list-style-type: none"> • VR • AR • MR • mLearning • eLearning** 	<ul style="list-style-type: none"> • Enhances learner motivation and engagement through behavioural principles of incentives, reward, sense of progress and accomplishment, and social engagement among others • Allows for broaching important topics in a serious manner without intimidating the learner • Allows for language and literacy barriers to be overcome
Human Centered Design	<ul style="list-style-type: none"> • Considering the needs of the intended learner at the core when designing the training / learning programme • This allows for the training solution to be context specific and match much more accurately the needs of the learner 	<ul style="list-style-type: none"> • VR • AR • MR • mLearning • eLearning 	<ul style="list-style-type: none"> • Enhances information retention and ease at which learners grasp complex concepts • Improves motivation of learners and allows for more rapid uptake and integration of concepts being taught outside the classroom















*mLearning: Mobile learning




**eLearning: Electronic learning

Sources: Desktop research, stakeholder engagement, RIIS team analysis.

Examples of Ed-Tech adoption across various industries show positive results which can be applied to mining

Numerous industries have seen the adoption of technology driven solutions to improve training outcomes. The learnings from these industries, as well as the most innovative training programmes in mining can be used to improve the training delivery and uptake of Zero Harm practices in the mining industry. Below are some case studies that have learnings which have been or can be applied to the South African mining industry:

Case study	Service Provider	Technology	Learning Trend(s)	Industry	Improved training / learning impact on healthy and safe production
Fusion Mine	BizAR Reality	VR		Mining	Analyze behaviors in high-risk virtual scenario to develop targeted training to improve behaviors if placed in real-life danger
VR Stope	Sts3D	VR		Mining	Model high risk scenarios in a safe environment to deepen understanding
Working at Heights	Sea Monster	VR		Construction	Earlier exposure of prospective workers to risky environments and testing for phobias before higher-hazard exposure to physical environment
VR Drill Rig	Sts3D	MR	 	Mining	Improved understanding and motivation of how to increase productivity safely, and how to identify and rapidly respond to real-life unsafe scenarios
Capitec Livin' It Up	Sea Monster	mLearning		Financial services	Demonstrated better engagement, knowledge-building and behaviour change which can apply to safe and healthy behaviours
Bloomingdale's	Axonify	eLearning		Retail	Increased employee willingness to undergo training while drastically reducing safety incidence and improving job confidence
Exxaro	WinWin	mLearning	 	Mining	Ease of understanding and improved knowledge retention allow for productivity revenue to be increased by \$90 million
CoronaRun	Sts3D	mLearning		Children's Education	Enables behaviour change and understanding of healthy and safe practices in a fun way, turning learning into play
Interactive whiteboard	Sts3D	eLearning	 	Mining	Enables deeper understanding and visualisation of complex engineering circuits
VR split circuit visualisation	Implemented at MRTA	VR	 		Model, practice and interact with high-risk scenarios in a safe, simulated environment to deepen understanding (interactive touchscreen with programmes)

Key of learning trends:  Human centred design  Micro-learning  Gamification

Bearing in mind the promise that Ed-Tech holds for effectiveness and efficiency, key enablers must be in place for successful implementation

An enabling environment

The correct infrastructure needs to be in place, and equipment procured, based on the technology or solution type(s) to be adopted. Trainees require easy access to **data** and/or **wifi**, necessary **devices** in all areas where training might take place.

Leadership that guides the way

Integration of training modernisation into the broader strategy, coupled with leaderships' buy-in and championing of the adoption of Ed-Tech is key to ensure a smooth and coherent adoption process across the organisation and for the right prioritisation to take place.

An empowering culture

A company culture where learning is encouraged and accommodated is key. Critical success factors include:

- Strong change management,
- A Learning & Development architecture where learning time and incentives are considered and accommodated along with production work, and
- A training approach which supports appropriate interaction with trainers, mentors or advisors (considering blended learning versus delivered exclusively on a digital platform), and detailed and helpful feedback for improvement.

SUCCESSFUL ADOPTION AND IMPLEMENTATION OF ED-TECH



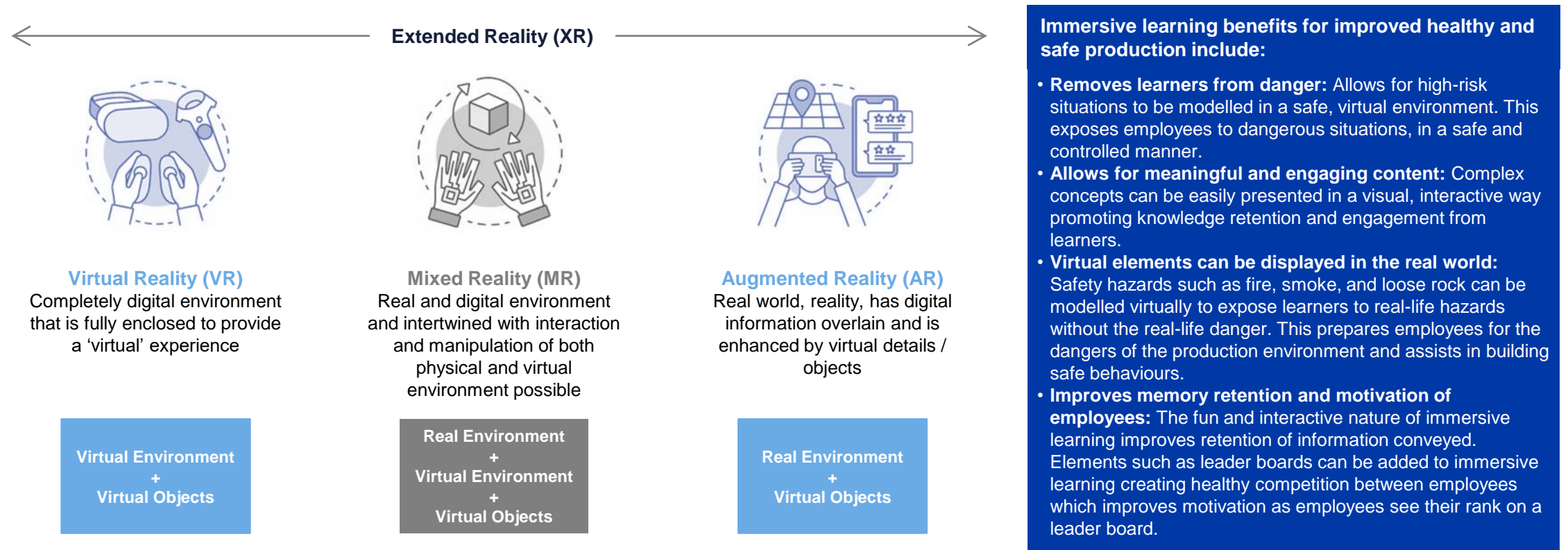
ANNEXES

- **Technology trend deep dive: Immersive Learning**
- **Technology trend deep dive: Device Based Learning**
- **Case Studies**
- **Acknowledgements**
- **References**

Immersive Learning: Augmented, Virtual and Mixed Reality

Immersive learning is a technique that makes use of an artificial or simulated environment through which the learners can become completely immersed in the learning process. It allows learners to control the outcomes by connecting them with real experiences, but in a safer environment. The extended reality (XR) spectrum encompasses the entire range of immersive learning techniques, covering the spectrum of experiences that blur the line between the real world and simulation.

For the purpose of the study three sub-groups of immersive learning have been considered, namely virtual reality, augmented reality and mixed reality:



Device-based Learning: Electronic and Mobile Learning

Device based learning utilizes a digital device of sorts as the medium for learning. Digital devices may range from ‘fixed’ devices, such as computers / laptops, for desk based in-depth learning, to mobile devices, such as smartphones / tablets, for on-the-go micro-learning.

For the purpose of the study two groups of device-based learning have been considered, namely eLearning and mLearning:



eLearning

Training conducted using a **fixed** computing device

Aim is to enable understanding and retention of either **specific skills** or **in-depth knowledge** on a subject

Benefits include:

- **Formal structure:** Training is designed to be static, and predominantly accessed from a desk allowing learners to separate the training environment from external environments and providing a structure to how and when training is done. This can assist learners in focusing on the information shared and increase concentration.
- **Improved understanding of specific skills:** eLearning enables learners to receive skill specific training that is easily digestible in 20-to-60-minute intervals. These specific skills are often conveyed using detailed information and graphics, and can be utilized to develop specific safety related skills such as hazard identification etc.
- **In-depth knowledge retention:** The integration of media, videos and gamification makes training more enjoyable for learners which promotes retention of the information being shared. This can help promote improved healthy and safe practices, as learners are empowered with a deeper memory and understanding of the information being conveyed.



mLearning


Training conducted using a **portable** computing device

Aim is for **quick knowledge distribution** and **instant** accessibility to information

Benefits include:

- **Portability:** Training is more convenient for users because they are often utilizing mobile devices / tablets which can be accessed from anywhere at any time allowing. Health and safety learning can be incorporated at various times in the workday to remind employees what is expected from them and promote behaviour change.
- **Flexibility:** Because training is done on a portable device, learners can access training when it is convenient for them. This also allows learning to be self-paced based on individual learners cognitive capacity, and training times can be adapted based on individual preference to promote knowledge retention.
- **Shorter duration:** mLearning allows for the utilization of micro-learning, which significantly reduces the cost of training as it requires shorter intervals. Training duration is often done in 3-to-10-minute periods, reducing the time of training significantly which results in learners having more time to implement their learning in a production environment.
- **Increased frequency:** Training can be done daily / weekly which improves memory retention and promotes behaviour change due to regular reminders which can be utilized for frequent refresher training. Learning becomes a more habitual, organic experience and can be regularly updated to include the most up to date incident reports, and how best employees can handle similar situations.

Fusion Mine – BizAR Reality



FusionMine.
Virtual Reality

Click here for an overview video of the fusion mine

Industry context	Mining
Technology	Virtual Reality
Application in training	Induction across workforce
Learning approach	Human Centred Design

Overview

The FusionMine virtual reality training platform uses the latest immersive technology hardware and software to provide trainees with realistic exposure to onsite working conditions. Each virtual reality training course is custom developed and designed to help individuals and teams improve safety, optimize performance, and drive efficiency through human behaviour analysis.

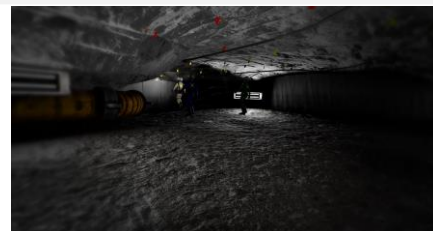
The training platform consists of a multi-user virtual reality training grid and high-tech vehicle simulators that integrate into the same virtual reality mine.

Problem Solved

- **Training on biggest safety challenges in a mining environment:** Fall of ground and vehicles interacting with people were the two biggest safety challenges identified. Numerous scenarios that address these challenges were modelled in a virtual environment to understand the impact human actions have on these challenges, and to train learners on how to overcome / prevent these challenges.
 - Training can be tailored across any occupation in the mining environment, and allows employees to understand challenges not only from their perspective but how their actions can have a knock-on effect on those around them
- **Incident reconstruction:** Specific safety incidence are not always easy for learners to understand, using virtual reality these incidence can be modelled, and learners can be exposed to real-life situations. Their behaviour can be monitored, and they can easily understand if there are any opportunities to react differently in a 'safer' manner.
 - New incidents can regularly be added to training allowing leaners to stay up-to-date on the latest safety challenges and apply the learnings / best practice into their jobs.


Impact / Benefit

- **Increased Collaboration:** Up to 25 people can be simultaneously trained in the virtual environment.
- **Human Behaviour Analysis:** Advanced tracking mechanisms allow you to track and monitor employee's progress which can be used to understand how different employees react in safety incidents.
- **Effectiveness:** Retention rates and productivity of employees have seen increases of 75% and 40% respectively.
- **Scalability:** Once courses are complete, they can be easily replicated in other locations. This allows for a much faster roll out and implementation of training after initial inception.



Sources: BizAR Reality interview and case study, RIIS team analysis.

VR Stope – sts3D

	Click here for an overview video of the VR stope	
	Industry context	Mining
	Technology	Virtual Reality
	Application in training	Induction across workforce
Learning approach	Human Centred Design	

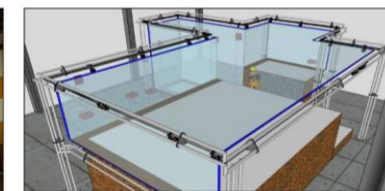
Problem Solved	Impact / Benefit
<ul style="list-style-type: none"> • Production is not as efficient as it could be: Crews can improve their ability to mark off their blasting patterns more accurately, drill straighter, and time the explosives better in the correct sequence so that the blast would hit the target and advance deeper, straighter and safer than they currently do. This could ultimately lead to improved and safer production. • The need to expose employees to the working environment safely during training: Taking trainees a few hundred metres to a kilometre underground takes time and coordination. In addition, the underground environment can be overwhelming and hazardous without the right level of training and experience. It is critical for trainees to gain knowledge and experience in practice, to understand scales of distance measurement - building muscle memory while reducing their exposure to hazards to a minimum. Trainees must be able to hone their skills through “trial and error” without putting themselves or others at risk. 	<ul style="list-style-type: none"> • Increased Production: Crews have a deeper understanding of how to perform their duties more accurately, leading to deeper advance, and higher-grade tonnages daily. • Improved safety: Employees have an improved understanding of how the quality of their work has a direct impact on the safety of the environment they operate in. By working more accurately the general safety of the environment is improved. <ul style="list-style-type: none"> ○ Safety incidence such as rock-fall resulting from a rushed safety examination can be simulated in the virtual environment. This exposes learners to the potential dangers they could face if they don't adequately complete their safety practices. • Step-by-step instruction, in a life like environment: Learners work through each step and are meticulously trained on the various activities they need to perform. This promotes muscle memory and allows for hand-on experience to be gained before they set foot underground. <ul style="list-style-type: none"> ○ Learners can inspect the quality of their work and understand the impact inaccuracy has on simple daily tasks when compared to an ideal example ○ Learners can also be assessed in this realistic environment to ensure competence. Detailed visual reports highlight any mistakes made.



8m x 2m VR Wall



2m x 2m x 2m VR Cube




8m x 4m x 3m VR Stope



Sources: STS3D interview and case study, RIIS team analysis.

Working at Heights – *Sea Monster*




[Click here for more information and an overview video](#)

Industry context	Construction
Technology	Virtual Reality
Application in training	Testing for suitability at heights
Learning approach	Human Centred Design


Problem Solved	Impact / Benefit
<ul style="list-style-type: none"> • Unable to accurately determine suitable candidates for the type of work: Employees were screened to determine if they have a fear of heights or not in two methods, both having their own downfalls: <ul style="list-style-type: none"> • Firstly, they were asked if they have a fear, and the challenge here arises if employees are either unaware of their fear or they try mask it as there is no incentive to be honest • Secondly, they are placed in a 'high' environment which is both costly, time consuming and a potentially dangerous situation. A person with a fear of height will often freeze when encountering a height and their behavior can become erratic putting both the trainer and trainee in danger. • Limited resources: There are a high number of trainees who need to undergo training at heights, but limited resources to conduct this training. 	<ul style="list-style-type: none"> • Improved safety: Employees can be screened for acrophobia (fear of heights) without having to place them in a high, and potentially dangerous environment. Using simple tests such as memorization tasks, employees can be screened not only for a fear of heights but also for how well they are able to operate at heights from the safety of the virtual environment. • Reduced cost of training: The virtual reality experience required an initial investment to develop the training program, which can then be rolled out to more locations once successfully piloted. There is also significant cost saved as employees no longer need to be physically taken to heights, which is often a very time-consuming process.



VR Drill Rig – sts3D


	Click here for a link to the company website	
	Industry context	Mining
	Technology	Mixed reality
	Application in training	Practical operator training
	Learning approach	HCD + Gamification

Problem Solved	Impact / Benefit
<ul style="list-style-type: none"> • Simulators are often very expensive and take up large amounts of space: Conventional simulators use heavy steel-framed containers laden several projectors and computers. These require significant investment to acquire, need a large area to be placed in and are often difficult to upgrade once they are installed. • Practical skills are hard to sharpen in conventional training: It is impossible for learners, while sitting in a classroom, to build the muscle memory they would gain from practically operating the drill rig. On the other hand, it is costly and dangerous to let inexperienced learners operate these multi-million-dollar machines. There is a need to convey a deeper understanding of how these huge machines work and the consequences of incorrect operation. Without practically experiencing the damage one can cause to a rig, or possible injury to self or others, it is difficult for learners to pinpoint the areas of their training that need to be sharpened to achieve optimal results. 	<ul style="list-style-type: none"> • Easy to use: The portable control panel is easy to relocate and set up with no heavy lifting or major calibration required. It is also easy to install, operate, facilitate, and maintain due to the small sized hardware capable of fitting in the boot of your car. Trainers can be capacitated in a short space of time, and even first time VR headset users mastering the controls within minutes. • Realistic experience: The virtual environment has been modelled to replicate the underground experience as closely as possible while the control panel was designed as a replica of the real thing - which exposes learners to the experience of operating a real drill rig. • Improves practical skills: The realistic experience allows learners to hone their skills and improve muscle memory as they operate a control panel identical to what they would use in their daily work shift. • Easy to interchange between different machinery or to upgrade: The modular design of the control panel allows for a simple swap out between different machine simulators, for example the drill rig control panel and simulation can be swapped for a bolter in just a few minutes.



Sources: STS3D interview and case study, RIIS team analysis.

Capitec Livin' It Up – Sea Monster



Click here for a link to the company website

Industry context	Financial services
Technology	mLearning
Application in training	Financial literacy
Learning approach	Gamification, micro-learning

Overview


To improve the financial capability of consumers (the knowledge, skills, attitudes and behaviours for sound financial decisions), Sea Monster developed a mobile game: a mix of home design, financial management and action-based mini games that plays out as a “real life story”. The game allows players to take on the role of several relatable characters as they save money towards long-term goals and receive guidance around basic financial concepts. Users select a dream, manage daily life and short-term expenses, go to work and earn virtual money, decide how to save and spend, and repeat to achieve the dream.

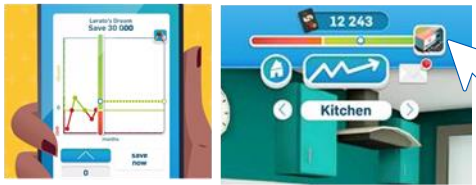
Problem Solved

- **A young population with over 50% living below the poverty lines:** Youth and young adults make up more than a third of the South African population, of which more than half live below the poverty line.
- **A population with little disposable income, that does not have saving habits:** Most income is used to cover basic living expenses, with only about 4% going to savings. In addition, general attitudes tend to favour spending disposable income over saving. Almost 30% of South Africans say they rarely or never set long-term financial goals and work to achieve them.
- **Low financial literacy:** Research has found that 59% of South Africans are financially illiterate, and this increases to almost **7 in 10** in poor households.

Impact / Benefit

- **Wide reach to target audience and user engagement:** Using SMS marketing and local media, Livin' It Up reached 27 719 unique users in the first seven months of the initial months. Over half of the players played two or more dreams during their lifetime – playing on average 5 dreams during their lifetime on the app.
- **Evidence of improved skill and confidence levels:** Through *interleaved learning*, players could temporarily “leave” a particularly challenging dream and tried an easier dream, allowed for successes and failures in other stories to gain the knowledge and skill and succeed the initially challenging dream.
- **User acceptability:** The game was carefully developed to suit the target audience, young South Africans with shared life stage goals, challenges in personal finances, tech-savvy and approving of digital solutions, which led to a good reception.
- **Measurability:** user attitude in the game to longer term behaviours in finances can be correlated to measure impact in long-term attitudes and capability.






Click on image for a link to case study video

Sources: Sea Monster interview and case study, <https://www.seamonster.co.za/portfolios/livin-it-up-game/>

CASE STUDIES

Bloomingdales – Axonify



Click here for more information

Industry context	Retail
Technology	eLearning
Application in training	Health & Safety refreshers
Learning approach	Microlearning, Gamification

Overview




Axonify helps deliver safety awareness training to more than 10,000 employees. Employees participate in 3–5-minute training bursts during their shifts (through POS systems or tablets on store floor), and training includes ladder safety, cleaning broken glass appropriately, correct way to use box cutters among others. The learning progress is tracked in the system allowing to measure direct impact on safety by correlating to month-to-month safety performance, employee job confidence, and voluntary additional learning participation.

Problem Solved

- **Employee engagement and behaviour uptake:** Bloomingdale's had standard safety practices training approaches which included awareness posters, classroom training, standard Learning Management Systems technology, and pre-shift morning rallies, which despite maintaining a low rate of safety incidents, did not engage employees enough.
- **Lack of consistency across departments and stores:** Being a large retail chain, the roll out and adoption of consistent training practices proved challenging.
- The training solution's key success criteria were as follows:
 - Integrate into employees' regular workday without taking them off the floor
 - Appeal to a diverse, multi-generational workforce
 - Offer flexibility to meet the unique challenges in different departments and stores
 - Provide a way to measure learning progress and tie back to the business

Impact / Benefit

- **Improved safety:** Safety claims were reduced by 41%, leading to cost savings of USD 10 million in claims
- **Employee motivation:** 90% voluntary employee participation in learning via Axonify, and 72% of employees reported preferring Axonify to other forms of learning
- **Employee self-efficacy:** 86.6% employees reported an increase in job confidence
- **Consistency in a large organisation:** Streamlined and rolled-out consistently across stores and departments digitally
- **Fast adaptation and roll-out:** After terrorist threats in NYC in November 2015, Bloomingdale's turned Active Shooter Training around within 24 hours for employees to immediately receive this training the following morning through Axonify system.

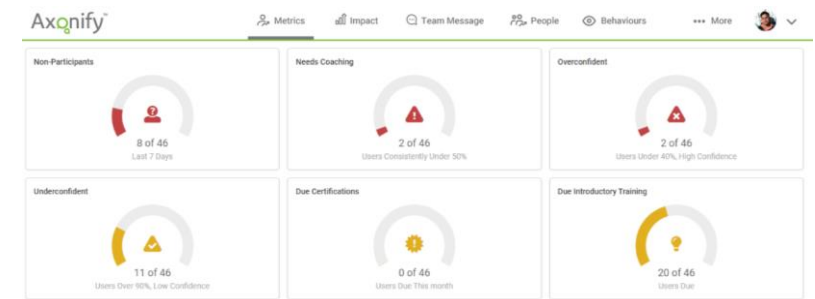
Leaderboard		
All Time		
Last 30 Days		
Top Performers in Rochester Store		
RANK		POINTS
1st	 Joanna Dilworth	256
2nd	 Jordan Bleams	250
3rd	 Bilal Khan	241




Correct!

+5 Reward Points

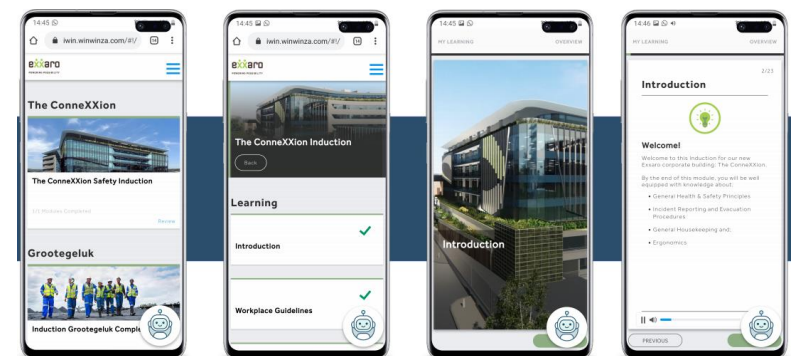
Even one bruised, spoiled, grey or otherwise damaged item can contaminate the entire display. Remove these items according to our guidelines.




Exxaro – WinWin International

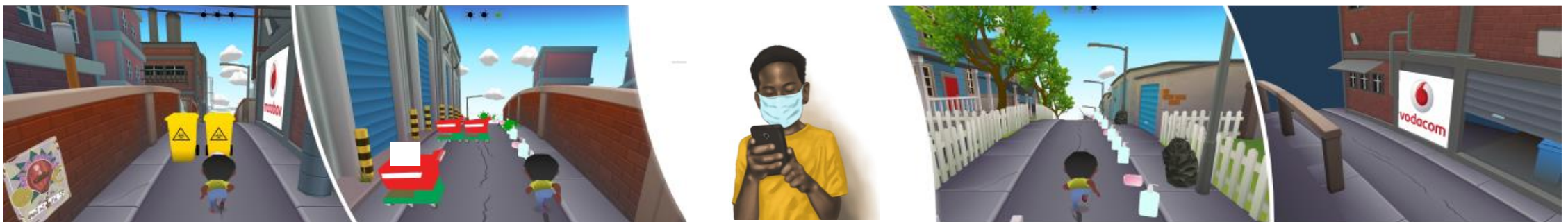
	Click here for more information on the case study
	Industry context Mining
	Technology eLearning; mLearning
	Application in training Induction, Function-specific
Learning approach Micro-learning; HCD	

Problem Solved <ul style="list-style-type: none"> Gap in digital literacy: Current mechanism of training was deemed complex and ineffective, dividing computer-literate and non-literate employees in uptake of training. Need for accessibility and scalability: <ul style="list-style-type: none"> The learning and development platform needed to reach 15,000 employees and contractors to learn, unlearn and relearn critical skills for the digital future. E-learning modules accessible via different types of devices, including mobile and desktop computers. 	Overview <p>A digitally-driven learning and development programme was developed and delivered through the IWIN platform – a cloud-based Learner Experience Platform. The platform adopted intuitive navigation to enhance engagement and ensure accessibility and effectiveness for employees with low-computer literacy levels. Development of 5 induction and 14 function-specific modules with media-rich content (videos, animations, 3D, 360* environments and multi-lingual audio).</p>
Impact / Benefit <ul style="list-style-type: none"> Efficiency: 70% time saved on average Effectiveness: a first-time pass rate of 90% Productivity: 9 productive hours saved per session per employee, which led to a productivity revenue increase of USD 15 million. 	






Corona Run – Sts3D

	Click here for a link to the company website	Overview
	Industry context → Children's education	<p>Living in the 'new normal' once the COVID-19 pandemic hit meant that people had to rapidly change their behaviour and in order to ensure their own safety and the safety of those around them.</p> <p>Corona Run is a 3-lane endless runner where the goal is for players to collect as many hand sanitizer and soap items as possible in order to fight the virus. While doing so, the player must avoid contaminated items which might spread the virus, such as shopping trolleys and trash cans.</p>
	Technology → mLearning	Impact / Benefit
	Application in training → Education on COVID-19	<ul style="list-style-type: none"> • Mobile Device based: The app can be deployed on both Android and iOS devices making it accessible to anyone who possesses a smart phone, tablet or PC. • Makes learning fun: The use of leader boards and online scorecards encourages learners to utilize the app and attempt to reach the highest score. Points are awarded for collecting items that help fight the spread of the virus and players 'lose' the game once they have collided with 3 'contaminated' items, which promotes avoiding these objects.
Learning approach → Gamification	Problem Solved	
<ul style="list-style-type: none"> • COVID-19 is spread through 'normal' activities: To mitigate the spread of COVID-19 there are a range of behaviours that need to be rapidly altered to achieve a 'new normal'. If people, and more specifically children are unable to rapidly adapt they could potentially harm themselves and those around them. These behaviours include: • Wearing of a face mask <ul style="list-style-type: none"> ○ Wearing of a face mask ○ Ensuring physical distancing when in public places ○ Sanitising frequently 		



Mechanised Mining Training – Murray & Roberts Training Academy

Featured industry application

 	 Click here for a link to the company website
	Industry context → Mining
	Technologies → VR, eLearning
	Application in training → Technical training
	Learning approach → HCD + Gamification

Overview

The Murray & Roberts Training Academy (MRTA) has digitalised significant components of its training offering to provide a coherent blended learning environment, where technology is leveraged to improve the effectiveness of learning and bring more efficiency to the processes. VR applications have been widely rolled out, including a 3D Blast Wall, VR checklists, survey and entry examination and safe declaration. Two **game changer** technologies, provided by sts3D have been incorporated recently and are featured below.

Technology solution: VR equipment split circuits visualisation

Split circuits diagrams for steering and brakes, drilling and drivetrain on VR can be visualised on the schematics and on the virtually duplicated equipment, components can be picked up and looked at, and the hydraulic and electric flows are animated on the virtual equipment.

Impact / Benefit

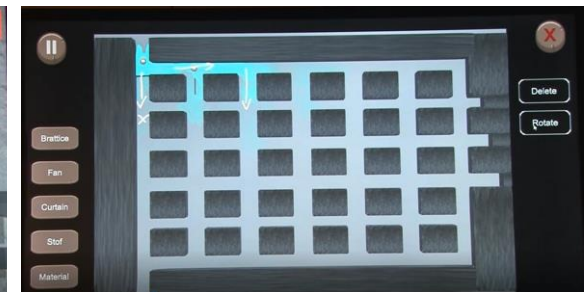
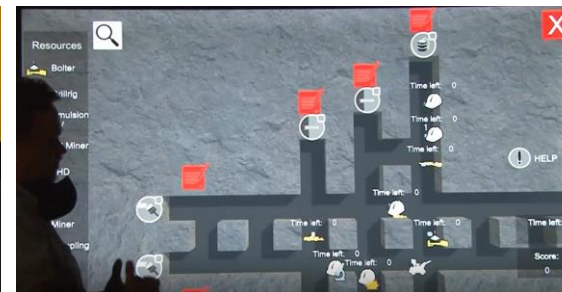
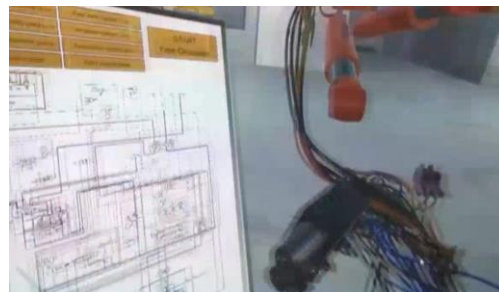
- **Easy visualisation translates to enhanced understanding:** The full immersion through the VR world allows learners to see the circuit flows as they go through the equipment, and compare this to the 2D circuit schematics.
- Fault finding and diagnosis – can identify them easier based on practice.

Technology solution: Interactive touchscreen for 2D / 3D simulations

A touch screen is leveraged to view and practice on simulations of: Ventilation flow, Mine cycle planning (planning and scheduling of people and equipment within a mechanised mining cycle), and Trigger Action Response Planning (with modelling of various geological features in relation to specific mine standards, and responses required).

Impact / Benefit

- **Convenience and portability:** The solution is run on a tablet and can easily be used in many environments, as it links to videos and files to access as needed throughout the simulations. This enhances the quality of presentation and helps facilitation.
- **Real time visualisation for understanding of consequences:** Real-time simulation allowing the learning to immerse themselves in the scenarios enables a better understanding of the consequences, and allows them to practice and “test and fail” for improved planning and forecasting capabilities.



Acknowledgments

A special thanks to the Subject Matter Experts who engaged with us for the compilation of this report.

Organisation	Interviewee(s)
BizAR Reality	Anthony Eva, Operations and Creative Director
Ceed Learning / Axonify	Ricardo Albertini, Digital Learning Consultant
Human Factor Hub	Neil Clarke, Managing Partner David Doull, Managing Partner
Inqubeko Training Academy	Jacques Kriek, Project Manager Stefanie Nel, Project Manager Erika Marais, Project Manager
MIASA	Vusi Mabena, Chairman
Murray & Roberts Cementation	Tony Pretorius, Education, Training and Development (ETD) Executive Mike Wells, Operations Director
Sea Monster	Ynze De Yong, Technical Lead Lebo Lekoma, Director of Client Services Kaylin Carrollisen, Community Manager
sts3D	Wilhelm Prinsloo, Managing Director Albert Jacobs, Director Johan Bouwer, Head of VR / New Technology
University of Pretoria, Dept. of Mining Engineering	Jannie Martiz, Ho Virtual Reality Centre Koos de Beer, coordinator, B.IS Multimedia and BIS Multimedia (Hons)
WinWin International	Stuart Woolmington, CEO Dylan Wingrove, Business Development Manager

Detailed collaborator profiles

A special thanks to the organisations which worked with us for the compilation of this report.



Axonify

Axonify is the modern learning solution for frontline employees that actually works. Employees love it—83% of users log in 2-3 times a week, which translates into meaningful behavior change that drives business results.

More than 160 customers in 150+ countries around the world, including Walmart, Bloomingdale's, Levi's and Merck, trust Axonify to fuel their people's performance to keep pace with their business. Founded in 2011, Axonify is headquartered in Waterloo, ON Canada.

[Read more about Axonify](#)



bizAR Reality

Over the past 6 years, bizAR Reality has successfully implemented numerous award-winning augmented and virtual reality solutions for various companies, operating in several industries. Our systems and procedures are highly structured and are optimised to ensure that each augmented and virtual reality solution undergoes a controlled process from ideation to implementation. Work with us to design, develop and deploy a value-driven augmented or virtual reality solution customised for your needs.

[Read more about bizAR Reality](#)



Ceed Learning

We help our clients improve performance and drive growth that show measurable ROI through learning and technology.

We use a world class methodology and platform to map the strategy and enable learning leaders to implement and monitor progress in a structured way.

[Read more about Ceed Learning](#)



The Human Factor Hub

Our consulting and training integrates a real-time technology platform and powerful analytics, with the latest in human factors science, to drive a targeted learning program.

For the organisation, this provides a process-based risk intelligence to decision makers, and improves productivity, quality and safety, as well as reducing the total cost of risk.

For the people, there is personal self-advancement, greater alignment with organisational purpose and engagement with safety and productivity.

[Read more about The Human Factor Hub](#)

Note: The Minerals Council South Africa engaged with the following role players in the mining and/or education ecosystems as part of its research and development of case studies. This report is not an official endorsement for service providers' products. We are grateful to these subject matter experts for their invaluable inputs into the research.

Detailed collaborator profiles

A special thanks to the organisations which engaged with us for the compilation of this report.



Inqubeko Training Academy

Inqubeko focuses on facilitating critical, fundamental and strategic skills development in the South African Automotive Sector. A fresh approach to skills development is required, due to – amongst other reasons – the 4th industrial revolution and its demand for the adoption of future production technologies. In this context, Inqubeko prides itself in developing state-of-the-art learning and training solutions to adapt to the specific challenges facing the South African automotive landscape.

[Read more about Inqubeko](#)



Mining Industry Association of Southern Africa (MIASA)

Founded in 1998, MIASA is an industry association gathering National Mining Associations from Southern African countries, aspiring to exchange best practices and ideas, encourage sustainable development in the region through the growth of a responsible mining industry, and address issues of regional interest.

[Read more about MIASA](#)



Sea Monster

Sea Monster shifts mindsets using unharnessed imagination, powerful digital technology and a fierce passion for storytelling.

Using our specialised skills in animation, gaming and immersive technologies, we solve the toughest communication challenges. The experiences we create have the power to grip hearts, spring people into action and shatter beliefs.

[Read more about Sea Monster](#)



Murray & Roberts Training Academy

The M&R Training Academy is a division of the Murray & Roberts Cementation Risk Department, focusing on occupationally directed technical skills and safety training. It is a fitting alignment in that everything we do is directed at managing the inherent risks that are common in people-driven workforces. Our objective is to make your workplace safer, more productive, technically proficient and values-driven.

[Read more about M&R Training Academy](#)

Note: The Minerals Council South Africa engaged with the following role players in the mining and/or education ecosystems as part of its research and development of case studies. This report is not an official endorsement for service providers' products. We are grateful to these subject matter experts for their invaluable inputs into the research.

Detailed collaborator profiles

A special thanks to the organisations which engaged with us for the compilation of this report.



sts3D

sts3D is a leading provider of virtual reality learning solutions for clients in the mining, chemicals, construction and energy industries. We have more than 50 corporate clients in 15 countries.

At sts3D our approach is to form strong partnerships with the mining industry and to work collaboratively with corporate clients in developing products which provide unique solutions. We share industry knowledge and expertise to build a stronger economy.

[Read more about sts3D](#)



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

University of Pretoria

Department of Mining Engineering and Department of Information Science

The Department of Mining Engineering collaborated with the Department of Information Science to provide a series of innovative, immersive learning experiences to its studies. The offerings include the Virtual Reality Centre, a VR Blast Wall, and other VR training solutions such as entry examination and safety procedures underground and vehicle inspection, among others.

[Read more about UP's VR Centre](#)



WinWin International

A training solutions developer with over 20 years experience, WinWin aim to empower organisations to achieve their goals through their own people, by delivering a variety of learning solutions that are aligned to their brand and tailored to the unique needs of their workforce.

We devise and drive innovative people development solutions and employee engagement strategies. Our range of services include traditional, digital, immersive and multimedia solutions, and corporate communications. As a proud Level 1 B-BBEE supplier we partner with our clients to bring the adventure back to learning!

[Read more about WinWin International](#)

Note: The Minerals Council South Africa engaged with the following role players in the mining and/or education ecosystems as part of its research and development of case studies. This report is not an official endorsement for service providers' products. We are grateful to these subject matter experts for their invaluable inputs into the research.

Sources and references

Fister Gale, S (16 February 2021) Case study: Pepsico leverages Minecraft for Lean Six Sigma training, *Chef Learning Officer*. Retrieved from <https://www.chieflearningofficer.com/2021/02/16/case-study-pepsico-leverages-minecraft-for-lean-six-sigma-training/>

Granpeesheh, D., Tarbox, J., & Kornack, J. (2015). Evidence-Based Treatment for Children with Autism.

Larson, R. (2 May 2017) Low-tech, High-impact, *EdTech Digest*. Retrieved from <https://www.edtechdigest.com/2017/05/02/low-tech-high-impact/>

Memon, M (10 May 2017) Experiential Learning versus Immersive Learning, *Training Industry*. Retrieved from <https://trainingindustry.com/articles/e-learning/experiential-learning-versus-immersive-learning/>

Milgram, P., Kishino, F., 1994. A taxonomy of mixed reality visual displays. *IEICE transactions on Information and Systems* 77, 1321–1329. Retrieved from: https://www.researchgate.net/profile/Paul-Milgram/publication/231514051_A_Taxonomy_of_Mixed_Reality_Visual_Displays/links/02e7e52ade5e1713ea000000/A-Taxonomy-of-Mixed-Reality-Visual-Displays.pdf

Munoz, S (29 May 2017) How Can Technology Help Cut Costs in Education? [Blog post]. Retrieved from <https://www.d2l.com/en-eu/blog/can-technology-help-cut-costs-education/>

Oesch, T. (11 April 2017) Training in High-risk Industries, *Training Industry*. Retrieved from <https://trainingindustry.com/articles/workforce-development/training-in-high-risk-industries/>

Saini, S. K., & Douhet, G. (2008). Revamping the military training system. *Journal of Defence Studies*, 2(1), 65-78.

Wentworth, D. (25 January 2018). The Impact and Potential of Virtual Reality Training in High-Consequence Industries, *Training Magazine*. Retrieved from <https://trainingmag.com/the-impact-and-potential-of-virtual-reality-training-in-high-consequence-industries/>



Minerals Council South Africa, in partnership with RIIS
July 2021

T +27 11 498 7100 **E** info@mineralscouncil.org.za **W** www.mineralscouncil.org.za

5 Hollard Street, Johannesburg, 2001, PO Box 61809, Marshalltown 2107



MINERALS COUNCIL
SOUTH AFRICA