

CSIR PRESENTERS: SKILLS

Full Name: Michael van Schoor

Company: CSIR

Designation: Principal Geophysicist

Qualifications: PhD (Geophysics)



Short Professional Biography

Michael van Schoor is a Principal Geophysicist in the CSIR Mining Cluster. He has 30 years' experience in applied research, primarily in the field of mining geophysics. His areas of expertise include electrical resistance tomography (ERT), ground penetrating radar (GPR) and borehole geophysics. He has authored and co-authored a variety of journal articles, conference proceedings and book chapters on the above topics and holds a PhD in Geophysics, which was obtained in 2009 from Lancaster University in the UK.

Full Name: Jodi Pelders

Company: CSIR

Designation: Senior Researcher

Qualifications: MSc (Ergonomics), PhD (Public Health)



Short Professional Biography

Jodi Pelders is a researcher in the CSIR's Mining Cluster. She has been involved in conducting research relating to human factors, health and safety in the southern African mining sector for over a decade. Jodi obtained her Master's degree in Ergonomics from Rhodes University; and completed a PhD in Public Health at the University of the Witwatersrand. Her research interests include fatigue management, workplace stress, physiological strain, incident analysis, women in mining, socio-economic and living conditions, and ergonomics, as this relates to mine workers in South Africa. More recently, much of her research involvement has related to modernisation of the mining industry. The research project clients include the Mine Health and Safety Council, Mandela Mining Precinct, and mining houses. Jodi aims to contribute to improving the health, safety, and productivity of individuals, and increasing sustainability in and around mines.

ASSESSMENT OF MODERN TRAINING INNOVATIONS FOR SUPERVISORS & TRAINERS IN THE SOUTH AFRICAN MINING SECTOR

SAIMM DIGITAL TRANSFORMATION IN MINING CONFERENCE: 25 JUNE 2025

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MANDELA MINING PRECINCT
MINDS FOR MINES



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BACKGROUND & CONTEXT



SML4CHANGE



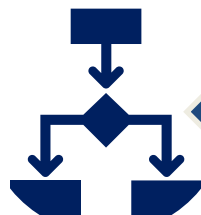
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Aim: To assess existing modern mining skills development training solutions for Supervisors and Trainers and to understand their impacts on people



Objective: To develop a guideline for the SA mining industry on training solutions to drive modern mining skills development for Supervisors and Trainers (for industry decision-support and in the context of mining modernisation)



Deliverables: Guideline with upskilling and reskilling modern training-innovations assessment to drive modern mining skills development for Supervisors and Trainers; and a consolidated matrix of the **training solutions assessments**.

BEST PRACTICE EVALUATION MATRIX

- Designed a comprehensive evaluation matrix based on *best-practice criteria* for evaluating training solutions – taking into account the overarching drive towards modernisation.
- The structure of the matrix is aligned to the ISO PDCA (Plan-Do-Check-Act) model as well as the ADDIE instructional design framework (Analysis-Design-Development-Implementation-Evaluation).
- The matrix comprised a total of 48 questions, which were further categorised into three sub-areas: Process, People and Product, each containing a subset of best-practice criteria.
- The assessment framework followed a SWOT-Analysis approach: No = Strong Weakness/Threat; Partially = Weakness; Yes = Strength; an additional column was added for recommendations on how to close the gaps or take advantage of opportunities, and to provide relevant context/information.
- Evaluation tool was refined through review and focus group interactions with a review panel comprising key industry stakeholders.



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BEST PRACTICE EVALUATION MATRIX APPLICATION - SNAPSHOT

ISO PDCA Phase:		PLAN				
ADDIE Step(s):		ANALYSIS				
Best-Practice Criteria		Evaluation Questions:	Assessment:			Recommended action to close the identified gap or change a weakness into a strength or take advantage of an opportunity to improve:
Identify industry needs & skills gaps			NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	
PROCESS	Evidence-based Training Needs Analysis	Has an evidence-based Training Needs Analysis been conducted to identify the training requirements for mine supervisors and trainers?	No TNA done.	Yes, a TNA was done but subjective or not focussing on supervisors & trainers.	Yes, an evidence-based TNA was done for supervisors & trainers.	
	Multiple source data collection	Has comprehensive data been collected from multiple sources (e.g., surveys, interviews, performance reviews) to identify training needs?	No data was collected.	Yes, data was collected but not from multiple sources.	Yes, data was sourced from multiple sources.	



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BEST PRACTICE EVALUATION MATRIX – CRITERIA

PART I – PLAN

Identify industry needs & skills gaps :

- Evidence-based Training Needs Analysis
- Multiple source data collection
- Documented & Accessible
- Stakeholder involvement (Needs Analysis)
- Stakeholder feedback collection & analysis
- Cultural considerations
- Future skills identification

Curriculum Design & Relevance :

- Resource planning
- Blended Learning
- Flexibility
- Stakeholder involvement (Curriculum Design)
- Learner-centric
- Job specific relevance
- Industry aligned objectives
- Competency & Outcomes-based
- Accreditation, NQF level, pitch & language
- Benchmarking
- Health & Safety
- Assessments

PART II – DO

Delivery:

- Effective implementation
- Latest changes in processes
- Learner engagement
- Support mechanisms
- Effective training methods/materials
- Effective facilitation

PART III – CHECK

Review:

- Continuous progress monitoring & evaluation
- Feedback collection
- Pre- versus Post-assessments
- Training outcomes evaluation
- Support and reinforcement mechanisms
- Application barrier strategies
- ROI consideration
- Knowledge retention
- Application of new skills
- Behaviour change
- Workplace transference
- Content relevance
- Conducive learning environment
- Safe performance improvements
- Productivity/Efficiency
- Tangible benefits

PART IV – ACT

Continuous improvement & Future Foresight:

- Action planning
- Sustainability measures
- Performance assessment
- Stakeholder feedback
- Commitment to change
- Curriculum validation
- Future skills identification



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ASSESSMENTS & EVALUATION – CONSOLIDATED MATRIX

PART I - PLAN	Best-Practice Criteria		Assessment (A1):			Assessment (A2):			Assessment (B1):			Assessment (B2):			Score	Rating colour
	Identify industry needs & skills gaps		NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)		
	PROCESS	Evidence-based Training Needs Analysis			2		-1							2	3	
		Multiple Source Data Collection			2		-1							2	3	
		Documented & Accessible			2		-1					-1			-1	
	PEOPLE	Stakeholder Involvement (Needs Analysis)			2		-1							2	3	
		Stakeholder Feedback Collection & Analysis			2			2	-1					2	4	
		Cultural Considerations			2			2			2			2	6	
	PRODUCT / OUTPUT	Future Skills Identification			2			2	-1					2	4	
		Curriculum Design & Relevance	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)		
PART II - DO	Best-Practice Criteria		Assessment:			Assessment:			Assessment:			Assessment:			Score	Rating colour
	Delivery		NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)		
	PROCESS	Effective Implementation			2			2	-1					-1	1	
		Latest Changes in Processes			2			2		-1				-1	3	
	PEOPLE	Learner Engagement			2		-1			-1				2	2	
		Support Mechanisms			2			2		2				2	6	
		Effective Training Methods/Materials			2		-1			-1				2	2	
	PRODUCT / OUTPUT	Effective Facilitation			2		-1				2			2	6	
					2		-1				2			2	0	
					2		-1				2			2	0	
					2		-1				2			2	0	
					2		-1				2			2	0	
PART III - CHECK	Best-Practice Criteria		Assessment:			Assessment:			Assessment:			Assessment:			Score	Rating colour
	Review		NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)		
	PROCESS	Continuous Progress Monitoring & Evaluation			2		-1				2			-1	3	
		Feedback Collection			2			2		-1				-1	2	
		Pre- versus Post-Assessments		-1		-1				-1				-1	-6	
		Training Outcomes Evaluation			2			2						2	6	
		Support and Reinforcement Mechanisms		-1				2	-1			-1			-3	
		Application Barrier Strategies		-1			-1			2		-1		-1	-1	
	PEOPLE	ROI Consideration	-1			-1			-1			-1			-6	
		Knowledge Retention			2		-1			-1				2	2	
		Application of New Skills			2			2		2				2	6	
		Behaviour Change			2			2		2			-1		6	
		Workplace Transference	-1					2		2				2	4	
PART IV - ACT	Best-Practice Criteria		Assessment:			Assessment:			Assessment:			Assessment:			Score	Rating colour
	Continuous Improvement & Future Foresight		NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)		
	PROCESS	Action Planning			2		-1				2		-1		0	
		Sustainability Measures			2			2	-1					2	2	
		Performance Assessment			2			2		2				2	6	
	PEOPLE	Stakeholder Feedback			2		-1			-1				2	2	
		Commitment to Change			2			2		2				2	6	
		Curriculum Validation			2			2		2				2	6	
	PRODUCT / OUTPUT	Future Skills Identification			2		-1				2			2	5	
					2		-1				2			2	5	

MIN	MAX	RATING COLOUR	
-8	-3		A cumulative score of between -8 and -3 indicates the most concerning weaknesses
-2	0		A cumulative score of between -2 and 0 indicates less concerning, but arguably still important weaknesses
1	3		Cumulative scores of between 1 and 3 can be considered as neutral
4	8		Cumulative scores of between 4 and 8 can be viewed as prominent strengths



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MOST CONCERNING WEAKNESSES

Most concerning weaknesses

- **Pre- versus Post-Assessments** – generally, learners' skills were not assessed before and after the training to determine new skills/upskilling and reskilling needs; it is mostly done only at the end of the training.
- **Support and Reinforcement Mechanisms** – it appears that there were often no mechanisms in place to support effective application on the job.
- **ROI Consideration** – the concept of return-on-investment (ROI) does not generally feature for the training programmes that were assessed.

Other perceived weaknesses

- **Documented & Accessible** - competence gap analysis results were not usually documented.
- **Learner-centric** – training programme are generally not tailored to meet the specific modernisation skills needs.
- **Health & Safety** – the training offerings do not necessarily equip supervisors and trainers with hazard, risk assessment and control measure information of the modernisation technology?
- **Application Barrier Strategies** – remedial/reinforcement strategies are not offered post upskilling/reskilling/new skills development.
- **Conducive Learning Environment** - the training environment is not always considered to be conducive to learning (e.g., comfortable, well-equipped, with modern machines technologies for learning).
- **Action Planning** – it emerged that specific actions were not always planned or implemented to address gaps or areas for improvement.



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MOST PROMINENT STRENGTHS

Most prominent strengths	Most prominent strengths
• <i>Cultural Considerations</i> - cultural factors and diversity aspects were generally considered; sometimes part of accreditation visits, advisory board meetings or part of professional body's requirements and demands. • <i>Resource Planning</i> - the necessary internal, competent resources (e.g., budget, materials, faculty) were allocated for the training programmes. • <i>Benchmarking</i> - curriculums were mostly aligned with OEMs standards and operating manuals, best-practices as well as future skills requirements. • <i>Support Mechanisms</i> - support mechanisms were put in place to guide learners to relearn new behaviours and unlearn old behaviours during the training. • <i>Training Outcomes Evaluation</i> - training outcomes were evaluated against the predefined modernisation/technology use and upskilling/reskilling objectives. • <i>Application of New Skills</i> – learners were enabled to apply the skills gained from the training in their job or in the training of workers/communities.	• <i>Productivity/Efficiency</i> - the training contributed to increased efficiency due to improved skills to deliver training/ supervise in the modern mining landscape. • <i>Tangible Benefits</i> – the training offerings considered seem to yield benefits, such as improved safe production, a better skilled workforce, upskilled supervisors and trainers as a result of the training. • <i>Stakeholder involvement</i> - key stakeholders (e.g., industry experts, trainers, supervisors) were mostly involved in setting the learning criteria for the training programme and its assessments; learning criteria were also sometimes aligned with company values. • <i>Job specific relevance</i> - the curriculums were generally considered relevant to the job roles and responsibilities of supervisors and trainers to support and enable modernization; for example, where fundamentals of mine safety is taught. • <i>Level and language</i> - training was pitched at an appropriate level considering the educational level of participants and their language. • <i>Effective facilitation</i> – the trainers generally had the necessary capacity, capability, qualifications and competence to deliver the modernisation content and address learner new skills needs; however, it should be noted that in some cases, technical roll-out and capacity constraints were observed. • <i>Behaviour change</i> – it was mostly agreed that the reskilling/upskilling and new skills development allowed for observable behaviour changes of supervisor and trainers; it was commented however that it was difficult to observe change in behaviour in the workplace and that employers should be better positioned to observe this. • <i>Future skills identification</i> - the faculty skills and competence requirements were generally assessed, to give faculty the required capacity development to support future skills demands; for example, allowing for additional lecturing staff for delivery

CONCLUSIONS & RECOMMENDATIONS

- Continuous review/ improvement as the landscape changes is critical e.g. for updates around training methodologies, content, facilitation, assessment and learner feedback approach, modernisation skills and training needs.
- There needs to be better alignment of curriculum with modernisation objectives to meet industry skills demands; to this end, professional bodies should be lobbied for input.
- Investigate initiatives to keep track of graduates to perform post-study validations.
- Better alignment of the assessment criteria with modernisation skills needs.
- Include more focus on risk assessment/control measures in line with the use of modern technologies.
- More immersive learning experiences and opportunities for practice/ practical exposure should be introduced.
- Continual improvement based on learner feedback.

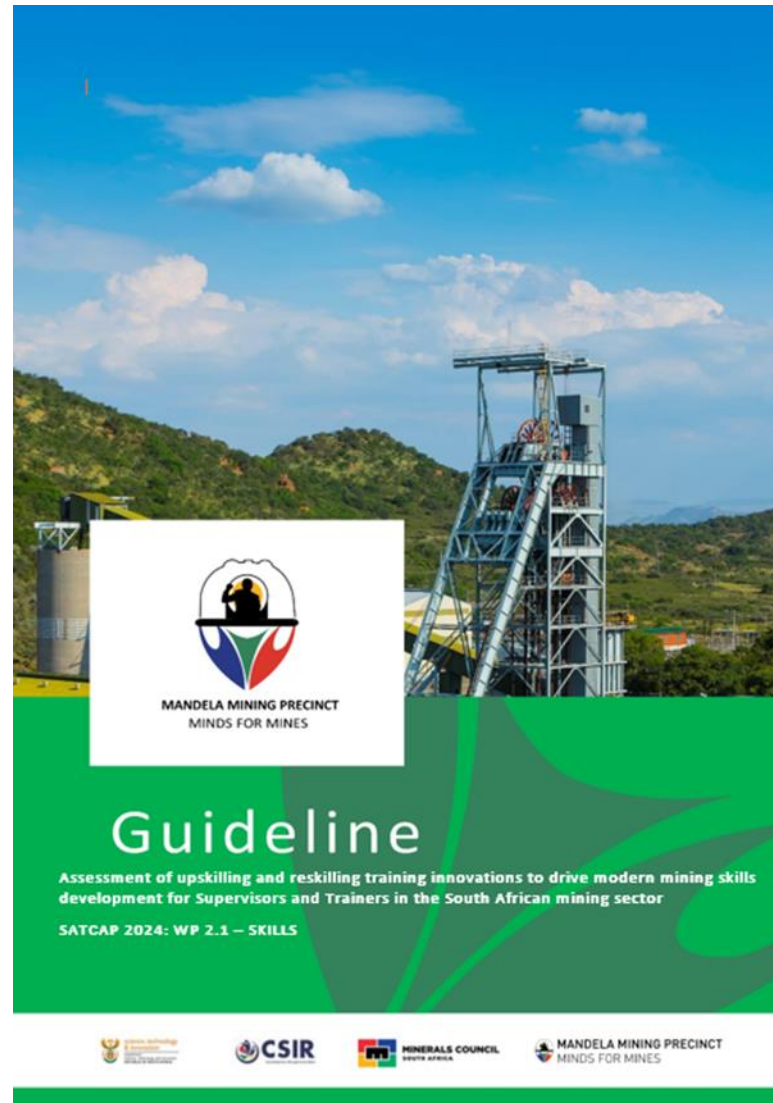
CONCLUSIONS & RECOMMENDATIONS

- Training entities to investigate how **linkages with industry**, DMRE can be leveraged to secure **additional funding** to support and sustain and even **expand current offerings**.
 - **Post-training opportunities in collaboration with industry** to be investigated- for example, behaviour change feedback, on the job application and remedial/reinforcement strategies.
 - Investigate how the **concept of ROI** can be better quantified, introduced to learners and related to training offerings.
 - Ensure that **continuous improvement** and **future foresight measures** are put in place; for example, through faculty skills and competence assessment and development.
- *There seems to be a definite need to embrace modernisation and digital technologies and that is not simply just about curriculum accreditation anymore...*



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FOR APPLICATION BY TRAINING ENTITIES - GUIDELINE

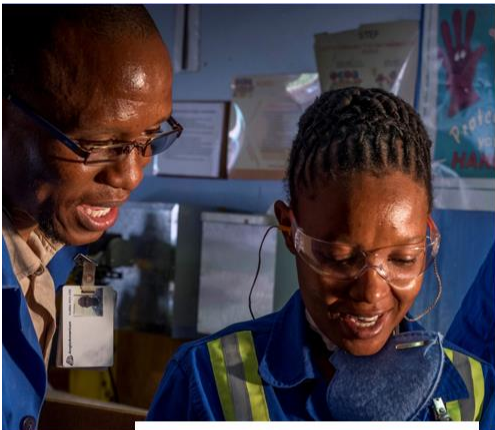


Benefit: To evaluate curriculum against modern mining criteria to meet industry skills demands



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GUIDELINE



CHAPTER 1

Project Aims, Objectives, and
Methodology



CHAPTER 2

Literature Review



CHAPTER 3

Analysis and Findings



CHAPTER 4

Results



CHAPTER 5

Conclusion and Recommendations

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