

Demystifying mine rehabilitation through differentiated learning

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Abstract

Quality practices within environmental, social and governance frameworks require that those charged with undertaking mine rehabilitation must work through various social and technical engagement steps on the journey towards a successfully rehabilitated mine. Governmental bodies play key roles in facilitating the rehabilitation of declared mine sites, working collaboratively towards safe, stable and sustainable landforms for the beneficial use of future generations. The information for, and education of, the community in Victoria, Australia, about the planning and processes for the rehabilitation of declared mine land in the Latrobe Valley need to be both inclusive and effective for all the community.

Governmental entities, mine licensees and even stakeholder groups themselves must engage with a diverse group of community members and organisations, each with different levels of knowledge and experience, and varied cultural perspectives. These diverse lenses influence how information is received, from whom it is received and how it is interpreted. Considering how this complexity can present, how can we meaningfully educate and connect with such a multifaceted audience?

Acknowledging that there is no ‘one size fits all’ solution in engaging minds in mine rehabilitation means drawing on already established, evidence-based educational principles. By embracing tailored, inclusive strategies we can foster deeper understanding and trust, and ultimately more successful and socially supported rehabilitation outcomes. We do not need to reinvent from within the walls of our individual organisations, but instead look to those who have already identified, codified and established the procedural norms that effectively educate the population, regardless of their community attachments.

Keywords: demystification, mine rehabilitation, education, differentiated learning, stakeholder engagement

1 Introduction

Mine rehabilitation is a complex, long-term process that sits at the intersection of environmental and social sciences, engineering, governance and community expectation. Within strong environmental, social and governance (ESG) frameworks, a fulsome and successful rehabilitation extends beyond the technical achievement of safe, stable and sustainable landforms to include meaningful social engagement and informed public participation. Government agencies, mine operators and regulators are increasingly required to not only undertake rehabilitation activities, but also to explain what rehabilitation is, how it occurs and what outcomes can realistically be expected over time.

This paper draws on the educational practices and experiences undertaken over the life of the Mine Land Rehabilitation Authority, which previously functioned as an independent authority of the Victorian Government, Australia. Although institutional arrangements have since changed and the author’s role now sits within Resources Victoria, the statutory responsibilities relevant to this work under the *Mineral Resources (Sustainable Development) Act 1990* – including continued engagement and education in support of Latrobe

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Valley coal mine rehabilitation and stewardship of the Latrobe Valley Regional Rehabilitation Strategy – have continued, providing continuity in function and practice.

A key facet of this function is providing information in an understandable format to the audience for which it is intended; that is; targeted information that accommodates the broad range of interests and comprehension that facilitate meaningful participation in the process.

When addressing the various aspects of mine rehabilitation, especially when it is intrinsically entwined with a community, no one message of any type can achieve this outcome.

This is particularly relevant in regions such as the Latrobe Valley, where large-scale mining has shaped landscapes, economies and community identities for many decades. The legacy of brown coal extraction visible in the altered physical environment as open cut pits and modified waterways reflects only some of the concerns. Other immediate and largely unknowable issues, including the social and economic fabric of the region, remain unanswered. Where generations of families and their communities have relied on the industry for continuity of employment and stability, there remain questions which are becoming more urgent as these mines approach closure and transition to their rehabilitation phase.

In the short term, communities may experience disruption, including workforce displacement and uncertainty about the future use of land and infrastructure. Over the longer term, the success of rehabilitation and transition efforts will influence environmental health, regional resilience and intergenerational equity. Understanding both the immediate and future implications is therefore critical, not only for regulators and operators but for communities who will live with the consequences of these decisions for decades to come. For the people in these communities the need for education is vital. Thus, rather than looking at the message as the starting point, it is vital to recognise the audience. Communities are comprised of many parts. Traditional owners, educators, industry representatives, regulators and advocacy groups bring varied levels of technical knowledge, lived experience, cultural perspective and personal interest. These differences influence how information is received, whether it is trusted and how rehabilitation concepts are interpreted. As a result, communication approaches that assume a uniform level of understanding or engagement risk excluding large portions of the intended audience.

Effective ESG engagement must therefore begin with demystification. Building a shared knowledge base allows stakeholders to understand key terminology, processes, timelines and objectives, and supports more confident participation in discussion and decision-making. Importantly, demystification does not mean oversimplification. Rather, it requires recognising that people approach learning with different abilities, motivations and prior knowledge.

This paper argues that established, evidence-based educational principles – particularly those underpinning differentiated learning – provide a useful framework for addressing the challenges of engaging effectively to highlight the changes occurring within the local mining industry, the process whereby the community can have a meaningful input into the final design of the landscape, and the career prospects during and after this transition. By applying proven teaching and learning strategies to community engagement in mine rehabilitation, organisations can enhance understanding, build trust, and support more socially informed and enduring rehabilitation outcomes. The resultant conversations are conducted with a more even level of understanding of the concepts at play.

2 Differentiated learning

Differentiated learning is an established, evidence-based educational approach that recognises and responds to the fundamental reality that people do not learn in the same way or at the same pace, nor from the same starting point. Rather than assuming a uniform audience and delivering a single message in a single format, differentiation intentionally varies what is taught, how it is taught and how understanding is developed, so that all participants can meaningfully engage with the core concepts being presented. At the same time, it allows individuals with greater interest, capacity or prior knowledge to pursue deeper and more detailed understanding (Tomlinson 2017).

Importantly for mine licensees and government agencies, differentiated learning is not about lowering standards or oversimplifying complex subject matter. Instead, it focuses on clarity and accessibility.

Educators identify the essential concepts that all learners need to at least have a grasp of, while providing multiple pathways through which the knowledge of those concepts can evolve and be explained, explored and scaffolded upon. Differentiation may involve varying language complexity, using different media formats, offering practical or visual representations alongside technical explanations, or creating opportunities for discussion and enquiry rather than passive information receipt. See Figure 1.

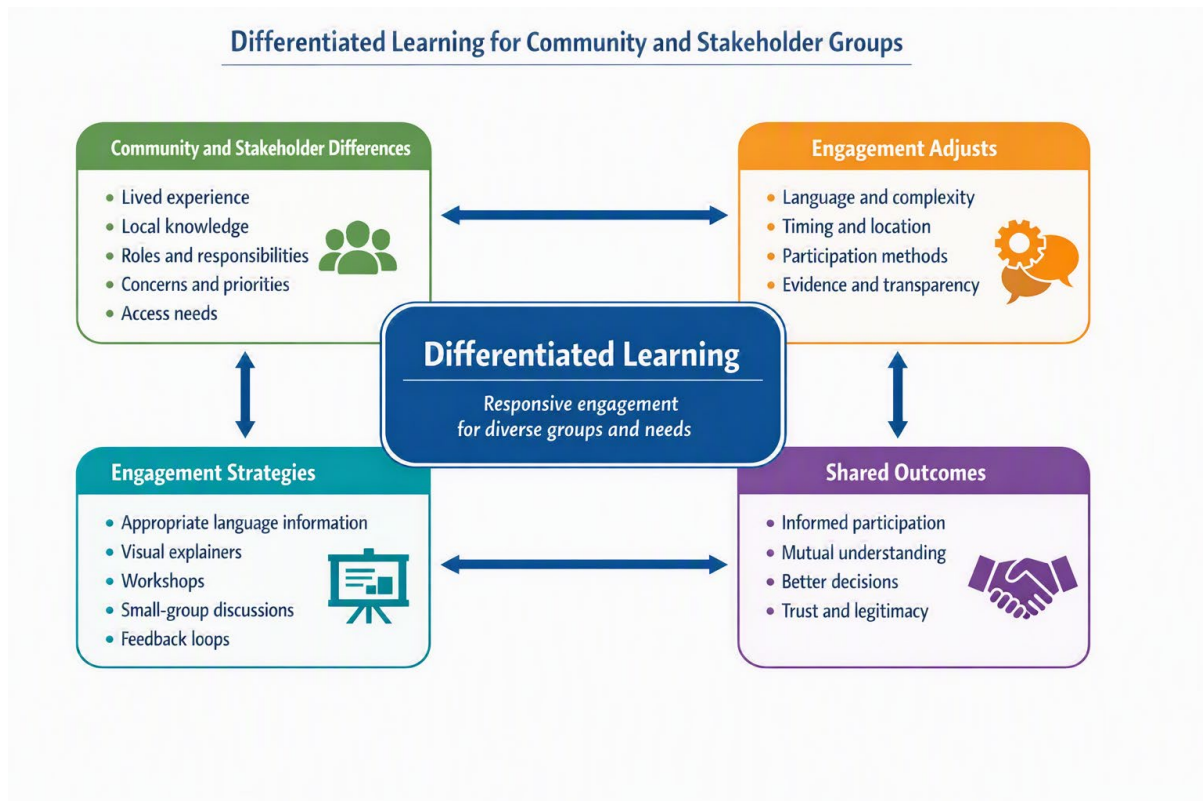


Figure 1 Differentiated learning model

At the heart of differentiated learning is the recognition that engagement is a prerequisite for understanding. People bring diverse experiences, cultural perspectives, motivations and emotional contexts to any learning situation. Effective differentiation takes these factors into account, acknowledging that relevance, trust and perceived values strongly influence whether learning occurs at all. As a result, successful learning design is not only about content accuracy, but also about awareness of the audience and intentional framing of the content to suit.

Differentiated learning is most commonly applied within formal education systems, particularly in contemporary primary and secondary schooling. Modern educators acknowledge that classrooms are inherently diverse and that effective teaching must respond to differences in ability, background, learning preference (e.g. kinaesthetic, visual, auditory) and prior experience(s). Strategies such as inquiry-based learning, formative assessment, scaffolded tasks and varied instructional modes are all expressions of differentiated practice (Jensen et al.2012)

Beyond compulsory schooling, differentiated learning principles are widely embedded in tertiary education, vocational training, professional learning and adult education. These contexts often involve participants with highly varied levels of expertise and experience, requiring facilitators to design learning that is flexible, relevant and responsive. Fields that deal with complex systems – such as environmental management, public health, emergency services and urban planning – routinely draw on differentiated approaches to support understanding, capability development and informed decision-making.

In recent decades, the influence of educational theory has extended into organisational change and community engagement contexts. While not always labelled explicitly as ‘differentiated learning’, many public-facing organisations now recognise the need to communicate complex information using multiple formats, levels of detail and engagement channels. Websites with layered information, visualisations of technical data, targeted briefings and interactive tools all reflect an implicit application of differentiation principles.

Simply creating a variety of informational sources, however, is insufficient. Without a clear and proven educational framework (Figure 2) – that is, understanding of how learning occurs and the steps to ensure a positive outcome – superficial building of a knowledge base is perhaps the best that might be expected. Educational practitioners are trained to begin with the learner, diagnosing their levels of prior knowledge and understanding of concepts, identifying barriers to engagement and refining approaches over time (Goyibova et al. 2025). This disciplined, reflective practice offers important lessons for public agencies whose consultative effectiveness depends on informed participation rather than simple information dissemination.

Structured Educational Framework				
A reflective learning sequence for planning, delivering and improving community engagement.				
Diagnose Establish what the audience already knows, what they need to understand and what may prevent engagement.	Prioritise Select the essential rehabilitation concepts, messages and vocabulary that must be made clear.	Differentiate Vary the level of detail, language, format and learning pathway to suit different audiences.	Engage Use enquiry, discussion, visual tools and practical activities to build active understanding.	Adjustments Use feedback and observed understanding to refine materials, timing, support and delivery.

Figure 2 Structured educational framework

It is also important to recognise that current communities include individuals who have already been educated within a differentiated, enquiry-based system. Thus, expectations around participation, transparency, dialogue and responsiveness have already been established as ‘the norm’. Indeed, graduate employees of governmental agencies and mining companies include an increasing number of these very types of learners. Engagement approaches that rely heavily on one-way communication or assume baseline understanding are increasingly misaligned with how people expect to learn and be engaged.

2.1 Why differentiated learning matters in mine rehabilitation consultation

Mine rehabilitation consultation presents a set of challenges that closely mirrors those addressed by differentiated learning in education. Rehabilitation is technically complex, extends over long timeframes, involves uncertainty and trade-offs, and is intimately linked to environmental values, community identity and future land use. Stakeholders approach these discussions with widely varying levels of technical knowledge, lived experience, interest and trust, yet all are asked to engage with decisions whose consequences may extend across generations.

Traditional consultation approaches often struggle under these conditions. Technical information may be accurate but inaccessible, presented at a level that excludes many community members or discourages participation. Conversely, efforts to simplify messages risk undermining trust if stakeholders feel complexity, uncertainty or constraints are being minimised or withheld. Differentiated learning provides a framework for navigating this tension by prioritising demystification rather than simplification.

Demystification involves identifying and clearly articulating the essential concepts that underpin mine rehabilitation – such as safety, stability, sustainability, risk, timeframes, uncertainty and beneficial land use — and making these concepts understandable to diverse audiences.

Differentiated consultation allows all stakeholders to develop a functional understanding of these core ideas while enabling those who wish to explore detailed modelling, technical data or governance processes to do so.

Enquiry-driven approaches, where learners can build knowledge by asking questions, are particularly important in this context. Communities engage with mine rehabilitation through questions grounded in lived experience: What will this landscape become? Is it safe now and into the future? Who makes decisions, and on what basis? What opportunities are created or foreclosed? By asking questions and receiving information, an understanding is scaffolded and consultation processes that recognise and legitimise these questions foster shared understanding and reduce the risk of defensive or disengaged responses. Rather than attempting to control narratives, differentiated enquiry treats questions as entry points for learning.

Differentiated learning also supports sustained engagement over time. Mine rehabilitation unfolds over decades, during which communities change, new stakeholders emerge and priorities shift. Consultation must, therefore, be adaptive, allowing individuals to enter the conversation at different points and develop understanding progressively. Education-informed engagement recognises learning as a continuous process rather than a series of disconnected events, aligning closely with life-of-mine and post-closure realities. A young student today may be the community leader of tomorrow.

From a governance perspective, differentiated consultation directly supports stronger ESG outcomes. When stakeholders understand constraints, trade-offs and decision-making processes, participation becomes more informed and constructive. While disagreement may persist and no consultation can guarantee stakeholder agreement, the quality of dialogue improves, and trust is less likely to be eroded by misunderstanding. Transparency and shared knowledge replace persuasion as the foundation of engagement.

Importantly, applying differentiated learning principles reframes community consultation as a capability-building activity rather than a transactional requirement. Communities are supported to understand, question and contribute meaningfully, building social capacity that extends beyond individual projects. This investment in understanding strengthens not only current rehabilitation outcomes but also future transitions and legacy land-use decisions.

2.2 Implications for practice

Mine rehabilitation consultation, indeed all consultation, should recognise and be intentionally designed as a differentiated, enquiry-based learning process. This requires clear identification of essential messages, deliberate variation of engagement formats and levels of detail, and ongoing reflection about who is being reached and who is not. Just as effective educators continually refine their practice, organisations involved in mine rehabilitation must be prepared to adapt engagement strategies over time.

Efforts that reflect this were incorporated into all educational materials produced for the Latrobe Valley under the auspices of the then Mine Land Rehabilitation Authority (now, Resources Victoria).

Examples include conversation starters like the ‘Sprout’ seed program, a family-based activity that involved planting indigenous, specifically selected, shallow rooted seeds in pots. Information about the seeds was contained on the seed stick covers which also contained links to the Sprout website, which had further links to mine rehabilitation. This activity allowed staff to visit public spaces and engage in planting activities while engaging in prior knowledge establishment, and the development and release of a free 3D augmented reality application that allows the user to see, explore and engage with the size and scale of an open cut mine as well as the physical characteristics, machinery used, surrounding landscapes and future options for rehabilitation. For the user the unspoken prompt is, ‘What are you interested in?’ (see Figure 3). The real learning occurs as they explore the possibilities in following their own pathways and learning what they need to as they go, all the while focused on mine rehabilitation.

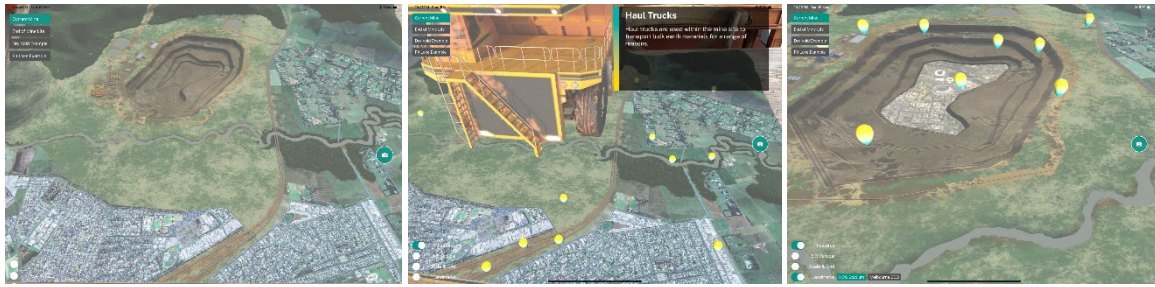


Figure 3 Three views of the 3D augmented reality application

In addition, the need for students to experience and enquire about the issues in mine rehabilitation necessitated the development and delivery of school lessons and activities are not only curriculum-aligned but designed, with scaffolded activities and inquiry questions. In addition, events to actually see and experience a rehabilitated mine within the Latrobe Valley as part of a class excursion were invaluable. A 3D augmented reality App was designed for when site visits were not possible (fig 3.) This complemented the plain-language public fact sheets that break down core rehabilitation concepts (e.g. water, landform stability, safety) into short, accessible explanations for an entry-level overview. Rounding out these messages is a series of short videos about key concepts (and concerns) that address the needs of members of the same community who require a different form of engagement. The combination of these efforts is to cater to a broad range of learning styles and needs.

Other efforts include general public open days and stakeholder conversations, direct communication via regular electronic updates, the development of a common accessible vocabulary, visits to radio stations for open public discussions and ‘meet and greet’ sessions with hands-on activities to reach the more disengaged, all the while promoting other sources of information that might make an impact.

None of these efforts are completely perfect of course; some work for a part of a group and others are effective for another portion. It is the cumulative effect of providing similar information in a variety of forms and levels of entry that generates a fuller understanding in the audience. But of course, this is the very point: no one activity or educational effort will satisfy 100% of the task. Teachers work hard in every class to reach all of their students all of the time, but they never assume one message will fulfil the need. Do other industries try as hard to get a message across?

3 Conclusion

In conclusion, differentiated learning offers a robust, evidence-based framework for addressing the educational challenge inherent in engaging stakeholders in mine rehabilitation. By recognising diversity, valuing enquiry and supporting meaningful participation, consultation can move beyond simple information provision and can move toward genuine engagement. Doing so helps establish the shared understanding of concepts and vocabulary, timeframes and phases of works, and establishes the trust necessary to support safe, stable and sustainable rehabilitation outcomes that endure across generations. This is the very essence of environmental, social and governance engagement, and should be the first step in establishing the rapport which the mining industry seeks in its activities – by talking with, rather than down to, some of the people most effected in these major works.

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References

- Goyibova, N, Muslimov, N, Sabirova, G, Kadirova, N & Samatova, B 2025, 'Differentiation approach in education: tailoring instruction for diverse learner needs', *MethodsX*, vol. 14, no. 103163.
- Jensen, JD, King, AJ, Carcioppolo, N & Davis, L 2012, 'Why are tailored messages more effective?', *Journal of Communication*, vol. 62, no. 5, pp. 851–868.
- Tomlinson, CA 2017, *How to Differentiate Instruction in Academically Diverse Classrooms*, 3rd edn, ASCD, Alexandria.