Article

A Theoretical Basis for Addressing Culture in Undergraduate Mining Education

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Competent navigation of cultural difference is critical to the management of social risk in the extractive sector as conflict associated with resource projects is often the consequence of a clash of cultures, as the extractive and growth values of Western, capitalist culture collide with the relational, stewardship values of indigenous cultures. Arguing that because most new mineral deposits are located on the traditional territories of indigenous peoples, intercultural competence should be a learning outcome of undergraduate mining education, a theoretical framework for a curriculum to support development of intercultural competence's skills and attitudes within the undergraduate engineering curriculum is presented.

Introduction

The term social license to operate, a measure of social risk, reflects the quality of company-community relationships in the extractive industries. Because most mining projects occur on the traditional territories of culturally distinct indigenous peoples, management of social risk requires that mining engineers build respectful relationships across the cultural divide.

Historically, mining education has not addressed culture, or included tools to engage with it, but as social risk increases (Owen and Kemp, 2013; Ernst and Young, 2018), failure to comprehend the cultural factors affecting industry-community trust, may explain the challenge of building relationships with affected communities.

Culture

Culture plays a role in conflict (Ting-Toomey, 1982; Avruch et al., 1991), including that associated with extractive projects (Kemp et al., 2010; Andrews et al., 2017). Because of culture's role in conflict, the study of culture must be included in the mining curriculum in order to understand the values that collide around extractive projects. Through an exploration of these collisions, development of relationship skills, and intercultural competence can be supported.

The encounter with cultural difference may be examined through a variety of theoretical lenses to provoke reflection upon the assumptions that hinder authentic and effective engagement between parties. Intersections and convergence of these lenses illustrate the potential for a curriculum which catalyzes a shift within engineering culture itself to increase graduate comfort with uncertainty and the unfamiliar.

We begin by describing how culture, and cultural change is understood in this work.

Defining Culture

Two definitions contribute to the way in which culture is conceptualized in this work. The first is ontological:

Culture provides the blueprint that determines the ways an individual thinks, feels, and behaves in society. We are not born with culture, but rather learn it through enculturation and socialization. It is manifested through societal institutions, lived experiences, and the individual's fulfillment of psychological and basic needs. (Gollnick & Chinn, 2009, p.31).

Schein described culture in epistemological terms, referring to *knowledge*—a core of beliefs and assumptions that may be unconsciously held, but expressed as the values and outward patterns of behaviour that guide choices and actions:

...a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid, and therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems. (Schein [in Godfrey & Parker, 2010, p. 6]).

In essence, culture encompasses the worldview and production (epistemology axiology, artifacts and practices) of a group. In the anthropological tradition, culture refers to a *kinship group*: a tribal group with a common ancestry. The anthropological lens facilitates the study of *constructed* groups, such as employees of particular corporations and *self-forming* groups, such as the *epistemic cultures* of disciplinary and professional communities (Knorr-Cetina, 2001).

The term *settler culture*, referring to those who arrived in North America after Indigenous peoples, is a hybrid of kinship and self-forming groups. It functions as a placeholder in decolonizing literature by invoking the binary of *otherness* (Spivak [in Silverman, 1993]), to comprise the entirety of worldviews that fall outside Indigenous cultural norms.

The professions, as well as the corporations that employ them, are also theorized to have distinct cultures (Wilensky, 1964; Moore, 1970). Wenger posits that *communities of practice*, composed of those who share skills and type of work (e.g., the professions) also share assumptions and values (1999). Wenger's model is frequently referenced in engineering education, where young people work collaboratively to adopt the norms of a profession and build their identities as engineers.

Cultural Change

Martin (1992) describes three models of culture and associated paradigms to conceptualize change over time. These are evident in work on cultural change, particularly in the context of corporate culture (Deal & Kennedy, 2000). These paradigms align with anthropological theory that cultural change is driven by:

- Environmental change
- Technological development
- New ideas resulting from
 - Diffusion, or
 - Acculturation

Because these occur over time, the shifts they trigger are theorized to also evolve gradually (Boyd & Richerson, 1995). However, following Kuhn's 1970 introduction of the *paradigm shift* to model the evolution of scientific theory and Eldridge and Gould's 1972 work on *punctuated equilibrium* in evolutionary biology, cultural change has been explained in similar terms (Durham, 1990; Gersick, 1991).

Weick and Quinn (1999) argue that cultural change occurs as a consequence of singular dramatic events that destabilize a system (such as a culture) to the extent that its equilibrium point is altered. Gladwell borrowed the term *tipping point*, from epidemiology (2000) to refer to the destabilizing events occurring at thresholds of cultural shift.

Organizational culture, too, is theorized to be malleable. Leaders are advised to *create or influence* the "corporate culture," which is defined as the rules, values, and norms that govern behaviour within a workplace (Burack, 1991; Hofstede, 1997). *The successful leader continually shapes culture to better achieve the organization's goals* (Atkinson, 1990).

The Culture of Engineering

A call for cultural change in engineering education (Institute of Engineers Australia, 1996; Godfrey & Parker, 2010; Mills et al., 2010), is persistent, but lack of agreement on changes sought and the role of curriculum supporting change are obstacles (Godfrey, 2003; Merton, et al., 2004).

Engineering's Cultural Values

Engineering students are known generally to be believers in the values of "economic growth" and technological progress (Johnson, 2016; Riley, 2008),¹ as well as being concerned about issues related to sustainability (Johnson, 2016; Carew & Mitchell, 2002)—more so than their (older) practicing colleagues (Brown, 2012).

Among the values that have been associated with engineering culture are: reliability, economy, safety, the potential of technology to solve the most complex problems, progress and innovation, curiosity and adventure, teamwork, competitiveness, hard work (Tonso, 2006; Heywood, 2005;

¹ Riley identified these attributes in American undergraduate engineers in 2008. To my knowledge, students of mining engineering have not been studied as a specific group.

Lucena et al., 2010), as well as, “a pleasure in technology,” and “pride in technical competence” (Faulkner, 2000, p. 109). Dunne observes that engineers dislike uncertainty and are uncomfortable when they cannot control the behaviour of components in a system. He suggests that this discomfort, combined with the unpredictability of people, may be at the root of the presumption that engineers prefer machines to people (2005). Significantly, for future mining engineers, these discomforts are also characteristic of encounters with cultural difference.

Epistemic Foundations of Engineering Culture

A culture’s worldview has its most appreciable and normative expression in its epistemology—not just its knowledge, but its beliefs about knowledge and the criteria it uses to validate or determine what *counts* as knowledge. Because a clash of epistemologies is often present in real-world conflict, a critical comparison of *epistemologies* has practical value in informing the design of complex systems where diverse cultures are brought together, as they often are in extractive projects.

Perry modeled the interaction between the cognitive and affective domains to scaffold learning over the entire course of college education (1970, [in King & Magun-Jackson]). Exploring shifts in students’ beliefs about knowledge resulting from their learning experiences, Perry mapped epistemology across four dimensions to show how these shifts might, in turn, alter cognitive processes:

- *Dualism*: knowledge is based on a single answer provided by an authority
- *Multiplicity*: knowledge is based on differing opinions,
- *Relativism*: knowledge is dependent on a given scenario, and
- *Commitment*: knowledge is based on known information.

Perry found that engineering students scored lower than other students on the dualism and multiplicity dimensions. Later studies confirm Perry’s findings: for example, engineering students are more likely than others to believe that *knowledge is certain* (Jehng [in King & Magun-Jackson, 2009]), a belief that is problematic for meaningful encounters with cultural difference.

The Schommer Framework, conceives of epistemology as having four 2-part dimensions, as shown in Figure 1. Together, they represent individual relationships to knowledge (King & Magun-Jackson, 2009).

Dimension	Description of Beliefs	
	Naïve	Sophisticated
Structure	Knowledge is simple, consisting of isolated pieces of information that are clearly understood.	Knowledge is complex, consisting of pieces of information that are related and dependent on the other.
Certainty	Knowledge is certain, absolute, and not changing.	Knowledge is continuously evolving
Control	Knowledge is innate and set or fixed.	Knowledge is incremental and can increase or improve
Speed	Knowledge is quickly obtained.	Knowledge is obtained by a gradual process.

Figure 1: The Schommer Framework

Schommer contends that beliefs about knowledge need not mature simultaneously. i.e. that beliefs in one dimension may be sophisticated, while those in another are naïve. For example, the *Structure of knowledge* dimension ranges from naïve to sophisticated. Similarly, the movement along Schommer's *Certainty* dimension begins with a belief that knowledge is certain, absolute, and immutable. With increasing intellectual development, students become less rigid in their conception of what counts as knowledge, and more cognizant of the fact that knowledge is expanding and subject to change, as both Dewey (1933) and Russell (2014) theorized.

This epistemological framework is consistent with transformative learning theory's position that learning in the cognitive domain can initiate changes in the affective domain, and that affective changes may be incremental and latent rather than immediate (Cranton, 2006).

Confronting Culture: The Theoretical Basis

Costa and Scoble (2006) argue that mining educators must produce "... global citizens who are politically, culturally, and socially aware," to show recognition of, "increasingly more diverse and complex responsibilities" (Scoble & Laurence, 2008), and to answer calls from industry that training goes "beyond learning the hard sciences directly related to engineering to encompass the soft areas related to people, ethics in society, and the environment reflecting the complexity of the environment in which decisions now have to be made." Hagan et al. want young engineers to be "able to work and communicate effectively across discipline boundaries" (2012). For mining engineers, these abilities need to extend across cultural boundaries, too.

The research on engineering education has not yet addressed "culture," or acquisition of skills associated with intercultural competence, although Costa and Scoble (2006, p. 8) state that, "The intention is to respond to current challenges, such as community participation in mining, sustainable development, capacity building, environmental impacts, risk communication, the concerns of Aboriginal peoples, land access, conflict and poverty alleviation, among others" (p 371).

The curriculum developed to address these questions was informed by the theories of transformative learning and situated learning, as well as critical theories, which interrogate implicit societal assumptions.

Adult Learning Theories

Because almost all of the tracked learning outcomes for Canadian engineering graduates reside in the cognitive domain (Engineers Canada, 2016), it is challenging to determine where in the curriculum, development of intercultural competence and dialogic skills might be included. The few outcomes specified in Canada's accreditation criteria which do reside in the affective domain—the learning that involves feelings and values—relate to teamwork and professional ethics: nowhere are issues of equity and empathy addressed (Engineers Canada, 2016).

Transformative Learning

Mezirow's theory of transformative learning provides a model for understanding how learning in the cognitive and affective domain relate, and how educators can support affective learning outcomes via learning in the cognitive domain. Mezirow states that, "Most of the process of learning occurs outside of awareness and may include emotional, intuitive, symbolic, imaginistic, and/or contemplative modes of learning" (Dirkx et al., 2006, p.124). Thus, for the purpose of assessment, the affective domain and its processes are troublesome. Mezirow contends however, that even though processes of transformative learning occur outside of the learner's awareness, learning can be accessed and consolidated if it is brought *into* the learner's awareness through reflection. He lists elements of awareness that are indicative of reflection upon epistemic assumptions and amenable to observation:

1. recognition that an alternative way of understanding may provide new insights into a problem;
2. context awareness of the sources, nature, and consequences of an established belief;
3. critical reflection of the established belief's supporting epistemic assumptions;
4. validating a new belief by
 - a. an empirical test of the truth of its claims, when feasible, or
 - b. a broad-based, continuing, discursive assessment of its justification to arrive at a tentative best judgment;
5. anxiety over the consequences of taking transformative action; and
6. taking reflective action² on the validated belief (Dirkx et al., 2006, p 124).

Importantly, for mining education, while the objectives of transformative learning reside in the affective domain, the *route* to desired affective outcomes need not be limited to learning activities that would be recognized as engaging the affective domain—indeed, Cranton (2006) presents a number of examples in which adult learners experienced a life-changing transformation as a consequence of learning in what might have been thought to be unremarkable, even "objective," subject areas. Dirkx observes that even though transformative impacts occur in the affective domain, the process necessarily involves a cognitive or rational process, in which a learner

² The learner elects to take different actions than he/she would have before the transformation. Reflective action means that the learner is aware that his/her knowledge has expanded and that this has led to a re-evaluation of assumptions and their influence. Taking reflective action is the final step in transformative learning, in which the learner intentionally acts according to transformed beliefs and values. Dewey (1933) said that reflective action requires "...active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it leads" (p. 9).

critically assesses her own epistemic assumptions, as their limitations come into awareness (2006). Thus, transformative learning is fundamentally a cognitive process not facilitated by aspirations or motivations alone (Dirkx et al. 2006, p. 133).

Belenky and Stanton (2000) conceive of transformative learning as a discursive process, an internal dialogue through which the learner develops capacity for reflection and critical thinking about unquestioned assumptions that have girded her relationship to the world. Mining's diverse contexts offer innumerable opportunities for such reflection.

Mezirow advises that the contexts where promoting transformative learning is most appropriate are those where problems involve reasoning about complex and highly contextual collections of information (2000). Problems such as those in mining provide opportunities to study cases illustrating the ways in which culturally determined worldviews or frames of reference lead to divergent attitudes. Facilitation of critical engagement can lead students deeper into to epistemic reflection and adoption of the inclusive and accepting frames of reference, which are also indicators of intercultural competence.

A curriculum designed to support the student understanding of culture will not be straightforward to evaluate: achievement of learning outcomes related to expectations and metrics for social responsibility and some aspects of culture can be assessed directly, but determining whether transformative learning has resulted is difficult because of latency and a limited assessment window.

Situated Learning

Eraut states, "Professional knowledge cannot be characterized in a manner that is independent of how it is learned and how it is used" (1994, p. 19). Situated learning theory holds that learning occurs when learners construct new, increasingly sophisticated models of reality, in response to observations and experience of the world.

For most professions, learning outcomes are prescribed by an accrediting body. While individual schools and instructors may enrich the learning experience, the defining outcome of all professional education is the production of a "professional"—here, a mining engineer.

A significant part of professional training includes socialization into the profession—internalization of its cultural norms, ideologies and practices (Trice, 1993; Dryburgh, 1999). Indeed, some argue that it is the development of an "identity" that characterizes successful engineering education (Walker, 2001; Stevens et al., 2008).

Situated learning theory models the process of socialization into a profession. It holds that learning is situated in *communities of practice*: social groupings held together, formally or loosely around an *enterprise*—an activity engaged in by group members—rather than a mere *interest* (Lave & Wenger, 1991). Such enterprises may reside in realms of recreation (clubs) or occupation (professions). Significantly, the communities of practice model views learning as an integrated cognitive-social process involving acquisition of skill and coming to identify with the group: acquiring a new cultural identity.

The education of mining engineers, can thus be seen as both a social and cognitive process. Lave and Wenger describe the process of enculturation into a profession through "authentic activity"—the use of professional tools in context, and they acknowledge the powerful influence of a profession's cultural norms on its novices.

The training of young engineers has traditionally been about “becoming an engineer,” as much as about acquiring the skills and knowledge required for practice (Tonso, 1996). Accordingly, critical engagement with cultural difference must be constructed within the norms of the profession, if training is to support a transformative learning experience that results in an engineer who is also culturally competent.

Critical Theories

Critical theories deconstruct the mechanisms by which the dominant elements in a society consolidate and maintain power. Educators can employ critical methodologies within the curriculum to enable students to recognize sources of oppression that contribute to social risk around mining projects. Critique infuses the disciplines of development and political studies, which examine mining impacts, but it is not a feature of mining education in Canada (CIM Mining Education Forum, Montreal, May 1, 2019).

Decolonization

Mining related conflict often occurs at sites with a history of colonization (Andrews et al., 2017). Decolonization theory examines the legacies of the colonial project and their effects upon peoples within nations that have a colonial past. It interrogates mechanisms by which cultural imperialism was (and continues to be) effected, as well as ways in which these mechanisms influence both colonized and colonizer.

Decolonization is an activist critical theory that seeks to “undo” colonization by re-establishing the legitimacy of Indigenous epistemologies through the interrogation of settler colonialism.

Battiste (2004) argues that the disciplinary knowledge expressed in the discourse of the professions institutionalizes hegemony of the colonizing culture. Speaking specifically of scientific knowledge, Harding (1992) and Luke (2005) explore the implications of imperialism on approaches to environmental knowledge. Decolonization theory argues that the education system is instrumental in privileging the worldview of the dominant group in a society—in Canada, that of the settler—including empiricism, individualism, and capitalism, and seeks to democratize disciplinary discourse via inclusion of broader epistemic perspectives (Canagarajah, 1999). Because dominance of the western epistemological paradigm relies on the avoidance of questioning the criteria by which knowledge is validated, specifically: empiricism, objectivity, and universality, confronting culture is imperative for decolonizing theory.

Decolonization is hostile to established conception of a robust extractive sector and to industry itself. It reveals that resistance to mining is not growing within a vacuum of ignorance or misunderstanding of industry, but rather, at least in part, because of a determined and compelling philosophy that is growing in influence, fueled by feelings of frustration felt by the cultural communities who continue to be oppressed in the post-colonial era, and by an awakening to global issues of social justice within academia. Within mining education, the role for the decolonizing lens can provide further insight into the chasm between worldviews that interact when a mine is proposed, and to how curriculum is presented.

While the political and social injustice felt by non-dominant groups in a larger society is recognized, there is as yet insufficient comprehension of the ethical implications of failing to recognize their knowledge, and in particular, the role of this failure in both conflict and the reinforcement of systemic injustices.

Power Knowledge

Foucault's Power-Knowledge theory unites Decolonizing theory with Transformative and Situated Learning theories to reveal an approach for educating young mining engineers. Foucault argued that *perspective*, rather than truth, determines what constitutes knowledge, while power determines *whose perspective* is legitimate. He observed that power is subtly reinforced through control of discourse (1980). Foucault's conceptualization of the interplay between power and knowledge offers an alternative way to understand the relationships among stakeholders in extractive sector projects. It is also key to re-imagining a role for the socially and culturally competent mining engineer.

Foucault's conclusions regarding the linkage between power and knowledge relied upon an initial rejection of the way in which language had been conceived. To capture previously overlooked qualities embedded within language, Foucault borrowed the term *discourse* from linguistics, redefining it as a combination of vocabulary, syntax, semantics, class/cultural norms, and etiquette, a single meta-concept.

Foucault concluded that power rests in the coercive and normative force of representation through discourse. *Discourse is the heart of power*: through it and in it, the epistemology and objectives of the dominant culture become embedded and reinforced. Discourse is thus at the heart of inequality, because cultural control of the discourse is both an exercise of power as well as an expression of power. Through discourse, knowledge and values are controlled, and for Foucault, controlling the worldview is the most potent source of power. This concern is echoed in Mezirow's charge that post-secondary education can be mere instrumental learning in which "...cultural canon, socioeconomic structures, ideologies, and beliefs about self often conspire to foster conformity and impede development of a sense of responsible agency" (2000, p. 8).

Lave and Wenger contend that the period of education imposes both external (desire for group belonging) and internal (desire to possess an identity) pressure upon the student to engage in professional discourse through the acquisition of disciplinary knowledge and adoption of disciplinary values—the power that is embodied in this knowledge is thereby both communicated and reinforced (1991). Reid and Ng (1999) explain the relationship between language and power in greater detail: as well as reflecting and creating power, language depoliticizes and "routinizes" power (p. 121). The *language* of dominance, they argue, reinforces the *relationship* of dominance, making inequality seem natural, beyond question, and thus, the fact that the language of science is laden with cultural values is difficult for members of the dominant group to comprehend.

Industry's discourse respecting sustainable development, might be explored within the mining curriculum to reveal assumptions that permit the dominant culture to overlook the concerns of affected (culturally distinct) communities, in order to model a critical, culturally-aware approach to the practice of engineering.

Traditional knowledge theories, relate more closely to Foucault's Power-Knowledge than to Decolonizing theory in that they deal with discourse, challenging the primacy of western scientific knowledge (Iaccarino, 2003) and suggesting that the relational and non-linear worldview expressed in traditional knowledge systems, such as those preserved within many Indigenous oral traditions, are equally valid and possess equivalent capacity for representing what can be known about a place. Berkes et al. (2000) warn that it should not be assumed that such knowledge is held exclusively by peoples who are recognized as "indigenous," but should be

understood to refer to knowledge about the symbiotic relationships of organisms in a particular place, which is preserved and passed from generation to generation through the oral tradition. Such holistic theories compliment Foucault's Power-Knowledge by their argument that the positivist knowledge tradition is not superior, but, as Nakashima and Roué describe, differently *constructed* (as cited in Mazzocchi, 2006). Local ecological knowledge theorists argue that place-based unique and precious knowledge is the inalienable cultural heritage of land-based peoples, for whom such knowledge forms part of their cultural identity and integrity (Mazzocchi, 2006).

Dialogue Theories

A number of classification systems characterize communication styles, and their assumptions (Morsing & Schulz, 2006; Krauss & Morrcella, 2006; Tufte & Mefalopulos, 2009). All contrast traditional transmission or *monologic* paradigms and those that are *dialogic*, or participatory. In recent years, the inadequacies of monologic approaches have become apparent, especially for communication of environmental risk (Fiorino, 1990; Tufte & Mefalopulos, 2009), yet truly dialogic models have not been adopted, notwithstanding the embrace of "stakeholder engagement" in business (Morsing & Schultz, 2006).

Conflict around extractive projects often begins with communication failure and the likelihood of failure increases with cultural difference (Triandis, 2000; Andrews et al., 2017; Perrson et al., 2017). Since communication styles and language systems are both cultural products and the means by which culture is transmitted, it is worthwhile considering the role of communication in negotiating cultural distance.

Beginning with a powerful analogy that emerges from a process that can be instinctively grasped, *Dialogue Theory*, or *Dialogism*, offers a non-threatening framework for conceptualizing relationships between not only individuals, but cultures. Although they are concerned with different characteristics and applications, the major philosophers of dialogue (Bakhtin, 1981; Buber, 1970) share the conviction that dialogue's defining quality is connection, or *relationship*.

As Mazzocchi notes, "Dialogue can become a tool for social cohabitation, as well as for discovering and enhancing knowledge" (2006, p. 466). Specifically, dialogue theory provides a tool for conceptualizing a knowledge state in which incompatible or contradictory conceptions are held to be true simultaneously. As the process of dialogue unfolds, these conceptions evolve: influencing each other by turns, creating distinct new understandings which comprise layers of meaning, perhaps a merged and comprehensive understanding, or perhaps a transformed and entirely unrecognizable understanding.

Bakhtin's dialogic model (1981) supports the development of a non-reductionist and inclusive view of diverse knowledges that will be useful for the culturally competent engineer. Because it avoids de-valuing Western scientific views of knowledge during the critical formative period of engineering education, in which students adopt the culture of the profession, Bakhtin's dialogism lends itself to the construction of a flexible knowledge framework that has the capacity to accommodate the evolving understanding of perspectives, which is needed to conceptualize and incorporate cultural constraints (e.g. those related to stakeholders) in engineering practice.

Dialogism provides the theoretical foundation for considering competing worldviews in a manner conducive to the building of respect, trust, and relationships. If young engineers are to be prepared to be culturally aware and effective communicators in the field, their training must

enable them to concurrently internalize disciplinary knowledge and acknowledge that all knowledge is a function of epistemological viewpoint.

Bakhtin conceives of dialogue as both *process* and *perspective*— a space created for conceptions that have no correspondence across cultures, so that, as meaning is collaboratively made and remade in a dialectic exchange, mutual understanding (or, as Bakhtin would contend, *truth*) emerges. Dialogism allows for acceptance of the simultaneous legitimacy of opposing views, suggesting that it is a truth that eventually emerges. Furthermore, dialogism can be taken a step further beyond simply allowing opposing views, to enable the modeling of mutually exclusive knowledges, and leading to a resolution through the dialogical process, i.e. a shared understanding of culturally contentious concepts.

Bakhtin's notion that *truth* is a composite of many truths is useful for interrogating the privileging of scientific over other forms of knowledge (such as traditional knowledge) and offers a framework for mediating between perspectives. It may be possible to employ this framework for responding to challenges to a worldview in a way that is non-threatening but which may still be a catalyst for transformation. Dialogism posits that various contradictory positions can be all be true and that a more comprehensive truth requires that these be assimilated into a new, nuanced and complete truth.

Dialogism offers a constructive, collaborative approach to negotiating difference. Significantly, Buber noted that dialogue is possible even where participants hold unequal power, but if *authentic* dialogue occurs, the outcome will necessarily be a transformed relationship of equals (2003). In Buber's view, dialogue's authenticity is a function not of speaking or being heard, but of the intention to understand the other and his/her experience (2003). Put another way, the ontological space between beings may be treated as distance— an impediment to relationship, or it may be treated as *opportunity* for relationship. Through dialogue comes respect and with relationship, the opportunity for partnership.

Cross Cultural Communication Theories

The term *global competence* has been proposed to capture the skills essential to twenty first century engineers (Lohmann, et al., 2006; Parkinson, 2009). Downey et al. (2006), describe global competence as the measure of an engineer's ability to work with colleagues who "define problems differently," a measure that is inadequate to capture the requirement for mining engineers to work with stakeholders, who may not share team goals or who may oppose them altogether. Several communication models theorize the intercultural encounter.

Cultural Intelligence (CQ) explains the phenomena of a) individuals functioning at high levels of competence within their own cultural milieu yet failing to function in other cultures, and b) success in unfamiliar cultural setting by individuals who are less socially skilled in their own cultural context (Earley & Ang, 2003). However, CQ is preoccupied with results-driven strategy, rendering this model antithetical to the goals of trust and relationship- building. In seeking to support achievement of *unilaterally determined goals* (i.e. by the party belonging to the dominant culture) in intercultural contexts, CQ is fundamentally hegemonic and mono-cultural.

Intercultural Competence

The Developmental Model of Intercultural Sensitivity (DMIS) proposes a set of skills and attitudes that enable effective engagement with cultural difference—intercultural competence

(Bennett, 1993). Attitudes that correlate with intercultural competence are observable in behaviours including:

- awareness that all perspectives are functions of culture
- respect for diversity
- appreciation of difference
- comfort within one's own culture
- self-reflection, and
- avoidance of the rush to judge motivations behind observed behaviours.

Intercultural competence requires skills that enable the appreciation and negotiation of difference through dialogic processes. As shown in Figure 2, the DMIS theorizes *developmental stages* of intercultural competence, which mark increasing capacity for interacting effectively with difference.

Figure 2: The Developmental Stages of Intercultural Competence

(adapted from Hammer, 2012)

Stages of development progress through:

- Denial: lack of awareness or denial of difference.
- Polarization: a problematized view of the world as “us” and “them.”
- Minimization: willingness but attendant only to superficial commonalities and shared values, and failure to appreciate deeper values.
- Acceptance: recognition of patterns of cultural difference as well as shared values.
- Adaptation: ability to shift one's own perspective and adapt behaviours in ways that are culturally appropriate but authentic (Hammer, 2012).

Although the DMIS does not confront the issue of asymmetric power between cultures, found in settler- or post-colonial contexts, it models development of intercultural competence, which is the objective for addressing culture within the mining curriculum.

The failure to confront power dynamics in intercultural encounters in the mining context requires the consistent application of critical theories to mining education, providing lenses through which social phenomena can be examined. Their application has potential to reveal to engineering students gaps in their worldview sufficient to initiate critical reflection upon modes of thinking that have become dysfunctional.

Challenges

Relationships between mining and communities must become more equitable—rebalancing the encounter with cultural difference, shifting towards epistemic openness through undergraduate mining education will help. Yet, even with a robust theoretical framework to inform the design of a curriculum that will support the development of knowledge, insight and skills associated with intercultural competence, there are impediments. Significant among the many obstacles, are a crowded curriculum (Boyle, 1999; McDivitt, 2002), workload concerns (Clarke et al., 2004), institutional disincentives (Huntzinger et. al., 2007), perennial debate around “soft-skills” (Berggren et al., 2003), pressures to maintain program consistency (Godfrey, 2003), in addition to lukewarm institutional support.

Yet, Canada’s commitment to Reconciliation with Indigenous peoples calls upon every sector to contribute. Speaking of the role of universities to support Reconciliation, David Barnard writes:

We begin to decolonize our universities by integrating indigenous knowledge, perspectives and worldviews into curricula, programs and services, and providing relevant training for those teaching and interacting with our students. When understanding of First Nation, Métis and other indigenous cultures is woven through all of our campuses, then real change will occur not only within the institution, but within the many areas of society that we reach (2015).

Challenges notwithstanding, for mining education, it is time.

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