Toward sustainable development;
Conflict management practice and education

by Erin McCullough and Emily Sarver

Social conflict is a recurring phenomenon in the human experience and serves as a critical mechanism for change [1-5]. It occurs when two or more parties perceive that their needs and interests are in direct competition with each other and believe they cannot be reasonably accommodated. Conflict over mineral resource activities, particularly the distribution of benefit and risk, has become an omnipresent issue throughout the world [6-7]. Contrary to common perception, however, conflict can be a positive, transformative encounter in some instances [2, 8-11]. For this to be possible, society and its acting agents must reconsider how to address conflict. What if conflict were only a challenge to try something different?

It is well-understood that the mineral industries must manage an increasingly significant volume of social conflict [12-13], which can be a costly externality impacting all of whom are involved. Conflict is commonly considered in a two-party sense, but this can deeply over-simplify the true number of stakeholders. Besides mining companies and community members, government policymakers and regulators, public interest groups and judicial systems, to name a few, bear the social expenses of poorly-managed conflict [4, 6, 12, 14-22]. It is desirable for interested parties to participate actively in a constructive way to pursue their needs rather than contributing to adversarial relationships, operational problems and legal costs [1, 4, 12]. Of course, some mining companies are already working to develop more productive relationships with their stakeholders, but there is undoubtedly still a gap between ideal and common practices. This gap can inhibit collaboration and threaten the potential for mutually-beneficial resolutions to complex social issues [12].

The consequences of conflict. There are many hidden and unrecognized costs associated with unhealthy conflict. An environment with successful conflict management systems enables productive personnel, makes more efficient use of financial resources and increases group cohesiveness [8, 11]. As such, environments like this are said to have "healthy" conflict [23]. The social benefit of successful conflict management is equally significant [17]. Relationships between mineral resource companies and communities are fragile; such companies rely upon social

license to operate [6-7, 15, 22]. When managed and resolved effectively, the process of conflict can promote partnership and strengthen community relations. This is because several varieties of conflict management and resolution systems promote inclusion, mutual respect and candid conversation. Environments that foster healthy, forward communication provide the highest likelihood of lasting harmony. Some stakeholders mistakenly interpret this healthy balance to mean total conflict avoidance – a form of ignoring conflict when it arises in hopes that it resolves itself. This is not a helpful resolution strategy because interests cannot be accommodated if they are not acknowledged by the parties involved. When any stakeholder is too uncomfortable to address conflict and consequently avoids it in entirety, the discomfort is only propagated to that stakeholder's constituents who depend upon them for resolution [23]. Unresolved conflict is enduring in nature, thereby causing prolonged social and financial impact.

A common example of enduring conflict is the fight over environmental culpability. Take, for instance, the case of the Midnite Mine project, which operated on lands of the Spokane Tribe in eastern Washington state. The uranium mine produced in the 1950s but reclamation activities were insufficient after closure in 1981 [24-32]. According to the U.S. Environmental Protection Agency (EPA), the acid drainage and water runoff from this site posed an immediate risk to the Native Americans living nearby [33-35]. Harm was indisputable; but determining liability proved to be an ongoing battle. The conflict involved multiple stakeholders and overlapping levels of federalism, and is a premiere example of the legal complexity involving a sovereign nation. In this case, much of the conflict persisted over human rights and social justice issues, particularly given tribal members developing cancer in association with the environmental impacts of the mine. Only after significant administrative involvement did multiple Federal agencies and the original mining company determine the division of financial responsibility for reclamation [29, 33]. Even after decades of injustice, the reclamation plan was only

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recently submitted (i.e., in 2015), and work is far from complete [33]. This case illustrates how even well-established administrative and legal systems can struggle to address the complexity inherent to mineral resource conflict, and therefore, may not provide timely decisions necessary to accommodate stakeholder needs and interests. Note that complications are not limited to cases where conflict is related to legacy impacts; indeed, such systems often also struggle to address very current issues.

Structured legal systems such as the United States justice system are sufficient for addressing some types of conflict, but often not the multidimensional social issues commonly experienced by the mineral industries. Such structured legal systems tend to be designed to resolve disputes in a systematic way, but there are several notable shortcomings with conflict resolution systems like this in the context of resource development projects. First, litigation is a financially expensive process for society and all parties involved [3, 14, 36]. Second, it does little to reconcile differences between parties involved. The U.S. justice system, for example, is winner-loser in nature since it is necessary for triers-of-fact to determine which party is right [3, 36-37]. As a result, one party may perceive a court's ruling to be unjust and perpetuate the conflict through other channels. Third, some varieties of conflict can be resolved out of court. If something can be resolved out of court, this may be a more efficient process. Parties that can cooperate to resolve conflict out of court may establish the long-lasting relationships necessary to promote win-win outcomes. Fourth, some disputes are not legal in nature and, therefore, cannot be resolved in court [14]. In some situations, such as conflict about the intrinsic sacredness of nature or other principled notions, the law is not useful for handing social aspects it does not govern [37]. Fifth, the records from U.S. proceedings are publically available. In fact, information can usually only be kept confidential by order of the judge. This means that resolving disputes through litigation that involve sensitive/private issues or trade secrets can be damaging to some of those involved [37]. Finally, and perhaps most importantly, judicial disputes may not appropriately address the complex needs of the parties involved [3, 6, 9]. Decisions tend to address exclusively the legality of an issue, not related social, spiritual or psychological implications [1, 17]. Other conflict-causing factors often may not be considered relevant by courts, even though they are intimately connected with the origin and continuation of conflict. Failing to address conflict holistically can prevent involved parties from attaining satisfaction from the decision, regardless of the ruling. For these reasons, out-of-court dispute prevention and resolution systems should be considered, and even prioritized, in some cases.

Conflict theory overview

Social conflict occurs in business, community, and interpersonal relations. Indeed, most conventional varieties of conflict, particularly judicial disputes, originate as social conflict. The theory of conflict has been extensively researched for centuries. Experts in this academic discipline propose that most conflict exists because of inequality (perceived or actual), miscommunication, and/or incompatible ideology [1, 5, 13, 16-17, 38]. Particularly, inequality of power can motivate social groups to use negative, and sometimes destructive, mechanisms to attract public notoriety for their cause [5, 7, 16, 39]. Unequal and unmitigated dynamics of power can be exercised by those empowered to make unfair decisions surrounding mining projects. Yirenkyi recounts that more than 20,000 people were forcibly financially compensated or relocated from their homes to make room for the Tarkwa Mine in Ghana [20]. In some instances, mining activity in Ghana has physically disrupted shrines, cemeteries and other sacred places [20]. Mining operational decisions such as these violate cultural respect, and have been observed to create significant social conflict among those involved.

The specific factors that tend to cause and exacerbate conflict between stakeholders of mineral resource projects, including local communities, have been the focus of numerous studies over the past couple of decades [12-15, 17-19, 40-41]. Whether examined by private alternative dispute resolution practitioners, lawyers, business consultants, political scientists, sociologists, economists, or minerals professionals (including academics, engineers and business managers) several recurring factors can be noted across a range of projects in a variety of geographic locations. These factors were grouped into categories as shown in Table 1. All three categories must be considered in conflict management efforts if resolutions are to be satisfactory to all and long-lasting [1].

Substantive factors are the measurable outcomes of mining activity [1] – what "everyone gets." Community members will inevitably assess whether they were adequately rewarded (given a "fair share") for allowing mining activity and its accompanying risk. Mining companies are socially culpable to share the benefits and shoulder the burden of their activities. If mining

operations produce unreconciled externalities (e.g., environmental pollution), local communities will begin to question the fairness of the social contract.

Psychological factors that serve as the basis for conflict relate to emotion [1], particularly stemming from uncertainty and distrust. Mining companies can address many emotional factors by being forward with their intentions and communicating the availability of reliable, open fora for local communities to offer input. Community members will be more confident in the project when they perceive the ability to have influence and become positively involved.

Procedural factors that cause conflict relate to formal processes [1], which must be perceived as fair and legitimate by those impacted by their outcomes. Mining companies can minimize this aspect of conflict by establishing and maintaining the public fora expected, and by providing sufficient prior notice and time for participation. Conflict will develop in communities where mining companies are perceived as secretive, or trying to evade a system meant to safeguard the public interest.

Conflict as it relates to sustainable development. Both "sustainability" and "sustainable development" are evolving concepts. Their definitions are not only dynamic but also highly dependent on context and perspective. Thus, goals for sustainable development of minerals projects may be competing, contradictory or even unachievable [42]. In fact, it has been argued that such variety enables some stakeholders to tailor the definition of sustainable development to suit their goals; using it as political rhetoric instead of legitimate practice [43]. Clarity in definition and intention on the part of all stakeholders can certainly reduce the volume of social conflict by preventing confusion and false expectations. This gesture of transparency also is a critical step towards earning trust as an approachable, forward community partner [13].

Integrating conflict management strategies in the mining and other extractive resource industries compliments the key tenet of the Brundtland Report: "development that meets the needs of the present without compromising the ability of future generations to meet their needs." [43]. The term "needs" is often interpreted to mean material resource needs, but really should be understood to include cultural, economic and social welfare needs as well. Social conflict primarily stems from cultural needs [13], such as needs for inclusion, influence, consistency, sanctity and fairness. Mineral resource projects

Table 1

Conflict-causing factors in the mineral resource industries.

Category	Factor
Substantive	• Real or perceived inequalities in the distribution of risk and reward. • Realized or potential environmental disruption and pollution. • Realized or potential community economic impacts.
Procedural	• Access to fair and legitimate permitting processes. • Transparency in communications. • Opportunities for public participation. • Provision of applicable and comprehensive laws or regulations. • Access to labor-management collective bargaining. • Availability of reliable information. • Mechanisms for resolving power asymmetry.
Psychological	• Fear. • Anger. • Confusion. • Perception of (in)justice (environmental & social). • Disruption of significant environments or sites. • Perception of cultural and diversity appreciation.

may be perceived by communities to challenge an ability to meet these needs, thereby fostering conflict.

Conflict management strategies can be employed to help communities understand that their needs and interests are not necessarily in competition with those of mining companies' [39, 41, 44]. Lencioni explains that conflict is both healthy and necessary for the success of any social arrangement and that conflict is a mechanism for social discourse, which when effectively managed, is the foundation for trust and commitment [23]. Mineral resource projects that lack trust and commitment on the part of its stakeholders can experience costly operational interruption from worker absenteeism and legal action. Lencioni and other authors have commented on this topic outline the benefits of healthy conflict: higher earnings, better stakeholder participation, higher performing employees, and more favorable public images [21, 23, 44]. Such benefits are of course factors that may either directly or indirectly contribute to sustainable development. Given that properly-implemented conflict management strategies help promote "healthy conflict," it is necessary to consider alternative dispute resolution as a potentially beneficial option.

Alternative dispute resolution (ADR). Alternative dispute resolution is a category of structured techniques designed to manage conflict without the use of formal courtroom litigation. For this reason, ADR is considered "alternative" to formal litigation [5, 14, 36, 45]. The most notable benefits of ADR systems for

Table 1

Conflict-causing factors in the mineral resource industries.

ADR process	Appropriate application	Example scenario
Negotiation	Parties are confident, trusting and cooperative. They are aware of and articulate of interests.	Community seeks donation pledge to annual charity walk from the mining company.
Mediation	Parties are willing to cooperate but lack sufficient consensus after negotiation process.	Traffic from mine employees overcrowds community roads during school drop-off and pick-up hours.
Arbitration	Parties are open to compromise but need a neutral evaluator to decide what is fair. They may also need a prompt decision.	Employees sign a contract guaranteeing "x" amount of pay but seek an increase to the fair market value of "y" pay. Workers strike after their initial request are denied. Parties are set in their positions, but neither are happy with the strike.
Expert decision	Parties are in conflict over a technical/scientific issue and are willing to defer to the expertise of a well-established practitioner in the field-of-question.	Community members observe that wildlife is encroaching on their neighborhoods. They accuse mining activity of driving the animals out of the woods. The community requests the mine to reduce activity, but the mine considers this migratory pattern normal. An expert is consulted to determine if mining activity is a causal factor for the animal behavior before the mine changes operationally.

conflict management, aside from developing an amenable solution, are intrinsic to the process itself. Most ADR methods place a heavy emphasis on developing productive working relationships, which in many situations are non-existent, strained, or may not otherwise be developed [12]. Take, for example, situations when mining operations are acting within full legal compliance, but local communities have different or additional needs that are not met/guaranteed by the pertinent law; that is, the conflict is not wholly of legal relevance. ADR is uniquely suited to address such conflict, requiring two-way communication to promote balance, restorative justice and social empowerment [38]. In circumstances where communities lack access to data or the expertise necessary to develop scientifically sound positions on highly technical matters, ADR processes are also quite valuable [12, 17]. Naturally, conflict occurs when information is treated as a commodity [T], and ADR seeks to level the playing field by ensuring that communication is effective (i.e., such that all parties have access to understandable information and have the ability to ask questions and respond). Furthermore, ADR is applicable in pre-emergent and pre-emptive conflict stages, a benefit that courts or formal legal channels generally cannot offer.

Common ADR processes include negotiation, mediation and arbitration. Negotiation is a process that involves two or more parties working together to attain satisfactory compromise. Mediation is when a neutral third-party intervener helps those involved find a mutually-acceptable resolution. Mediators who facilitate the negotiation process neither represent any party involved nor decide upon the resolution [16, 36-37]. Arbitration is

similar to mediation in that there is also a neutral facilitator, but differs because the facilitator is participatory and (usually) decides the outcome of a given case [16, 36]. Another ADR process termed expert determination is also emerging for technical issues. In this conflict resolution process, a mutually-agreed upon a technical expert in the subject regarding the dispute decides upon the case. Expert decisions can be more satisfactory than litigation to the parties because the technical merit of the case is the deciding factor [17]. Additional varieties of ADR do exist [46], and can vary procedurally in different cultures. Table 2 summarizes the four ADR processes above.

ADR processes are not yet established as common practice throughout the global mineral industries – perhaps because many parties fail to recognize opportunities to participate in early prevention and resolution, or do not believe that the opportunities presented are legitimate. Certainly, it is ideal to settle conflict at the lowest level possible through fair participation to end the enduring conflict and foster positive relationships. When this is not possible, litigation remains an important and viable option [5].

Ideally, optimal conflict management strategies are those that prevent conflict in entirety. There is a variety of ADR and conflict management approaches that may be used to anticipate and address conflict in its pre-emergent stages [12, 14-16, 45-49]. Although unique in application and specific procedure, all conflict prevention methods fundamentally depend upon stakeholder inclusion and facilitating public fora for open communication between stakeholders. Community goals and priorities should be included using participatory planning in all aspects of a mining project

plan from conception to reclamation because it helps build consensus and pre-emptively addresses concerns. This gesture of public inclusion (sometimes referred to as "preventative mediation") can promote community buy-in since people tend to identify positively with projects in which they meaningfully contribute [8, 49]. This tends to make involved parties more likely to honor their agreements [36]. Furthermore, neglecting to include all stakeholders might motivate some to misinterpret the actions of others, and potentially draw a negative conclusion about even well-intended efforts [16]. For these reasons, it is important to build trust among stakeholders before conflict arises [12, 39]. By following through on even seemingly small promises and expectations, stakeholders are better equipped to work together when times get rough. This is well-argued in sustainable development literature, where the concept of "social capital" is frequently used to refer to the health of social networks [50-52]. Social capital is high when a network is well connected with open lines of communication because this promotes discourse, compromise and cooperative decision-making. When social capital is low, projects can stagnate because there is insufficient consensus to move forward.

True public inclusion differs from one-sided community meetings, in which company plans are communicated to those who will be impacted [47]. Community meetings promote weak engagement since they offer little-perceived decision-making authority to those impacted, and this unequal division of power can reduce social capital [16, 47]. Successful conflict managers must use public inclusion to communicate company culture and values [53], and also to become aware of the culture and value of others. In fact, social scientists often contend that public inclusion is a human right under the "participation principle" [43]. Regardless of the perspective on obligation, neglecting the role of community participation in conflict management can be a socially harmful decision [54].

It is important to recognize that ADR is not the proper process for resolving all varieties of conflict, especially those of violent, irrational or deceitful nature. Conflict arising from self-interested behavior of an individual or organization that breaks basic social norms or laws does indeed require intervention from established formal authorities [5]. For example, ADR is not appropriate to address improper disposal of hazardous wastes. Equally important, conflict management and resolution strategies must be culturally solvent [55]. Applying ADR strategies in situations of conflict with communities (most notably, indigenous) that do not prefer or acknowledge such techniques might create substantial power imbalances that worsen, rather than resolve, problems [21].

Finally, it must be recognized that ADR is only a viable option when all parties are willing participants and believe that their situation is improvable through this process [5, 16, 56]. Stakeholders that are forced into ADR processes or who lack a certain degree of optimism are less likely to be cooperative and receptive to others' interests, thereby hindering a meaningful resolution [1].

Educating the next generations of engineers

Given that effective conflict management, via ADR or other means, is a critical component of sustainable development initiatives – one of the many tools in the toolbox, so to speak – it is important for industry leadership at all levels to gain both knowledge and experience in this area. Since the extractive industries tend to cultivate leadership in technical experts, a very strong argument can be made for integrating sustainable development principles broadly and conflict management tools specifically into engineering curricula (e.g., Mining, Petroleum or Gas Engineering). Indeed, the responsibilities of engineers in the extractive resource fields continue to expand to cover a variety of business and social aspects [57]. Thus, academic programs are being challenged include much more than technical training.

For mining industry projects in particular, the growing expectations to demonstrate contributions to sustainable development are inextricably linked to social license and community engagement. The engineers that design and operate mines must also be competent to identify, communicate and mitigate the broader impacts of their work; and all with input from stakeholders that may have very unique perspectives. Beyond the technical and economic competencies that have traditionally been strengths of mining engineering curricula, many programs are now integrating social and environmental competencies as well [58-60]. However, apart from a keen focus on occupational health and safety considerations, progress in integrating the major social (i.e., community and public) aspects of mining has been slower – and conflict management training remains specifically lacking.

The current status of sustainable development education, in a broad sense, in mining engineering is not unlike that of most engineering disciplines (e.g., mechanical,

electrical, chemical, etc.) Change is being driven by external forces (i.e., societal demands), and the facilitators are often faculty with specific interests and knowledge. In a comprehensive survey of undergraduate engineering education in the United States, Allen et al. described the incorporation of sustainability content into curricula as having "a significant level of 'grassroots' activities but little structure or organization" across all disciplines [61]. That description reinforces the notion that a pedagogical transformation is underway, but highlights its gradual and ad-hoc nature.

What is different about mining (and arguably all extractive resource fields) as opposed to many other engineering disciplines is the sense of urgency surrounding the shift toward more sustainable practices – and thus the need for appropriate tools and strategies. This urgency is surely tied to the concept of resource dependency (i.e., we do not choose where the resources are located or which resources society demands), and the resulting ties between mine operators and local communities or other stakeholders with local interests. Into the foreseeable future, much of the tough work to be done by mining professionals, including many engineers, will undoubtedly be in addressing stakeholder conflicts that arise over the distribution of risks and rewards for the exploitation of a non-renewable resource.

Integrating conflict management into evolving curricula. So how do we effectively integrate conflict management education into engineering curricula? The most straightforward opportunities are likely within the already evolving framework of sustainable development education. Regarding content, or "what" to integrate, certainly foundational knowledge on conflict sources, management theories and resolution strategies are necessary. But, like other concepts and processes that are fundamentally tied to the context of a problem (e.g., ethics and ethical reasoning), learning about conflict can be enhanced by lessons that involve methods such as role play, critical review of specific case studies, and "what-if" analysis [e.g., 2, 36, 62-64]. It is important to note that such lessons are really meaningful because they provide opportunities for students only to apply their foundational knowledge, but also to learn and practice core competencies including cultural and diversity awareness; effective communication; collaborative problem-solving and ethical decision-making.

Beyond what content to integrate, the when and where to do so are also important questions

from a pedagogical perspective. Arguably, a one-size-fits-all strategy is not appropriate across mining engineering programs, which possess strengths based on their unique approaches to curriculum. Some general pedagogical guidance, however, might be taken from threshold concept theory.

This theory has gained significant traction in engineering education recently as a more effective and strategic way of integrating concepts that are key to further development [65-68]. Threshold concepts may be primarily technical in nature (e.g., a solid grasp of algebra and calculus are needed to apply numerical problem-solving methods), but also include "softer" concepts. For example, an understanding of sustainability principles is key to identifying the wide range of criteria, including conflict management, for sustainable mine design. As a basis for pedagogy, the theory holds that threshold concepts, hard or soft, should be introduced early on in the learning process, such that subsequent lessons provide opportunities for gradual mastery in a variety of contexts [65-68]. With this in mind, a deliberate model for integration of sustainable development concepts broadly and conflict management content specifically might be devised.

The potential benefits of such a model may be better illustrated considering that threshold concepts are often viewed as transformative, meaning that once a student fundamentally understands a concept they may view their future work in different ways [69-70]. From this perspective, a real goal of integrating sustainable development into early parts of mining curricula is to promote engineers that identify with the concept and see clear links between their work and sustainable development outcomes. Similarly, particular focus on conflict management within this thread may serve to reinforce key sustainable development principles and further develop engineering identities that include distinct roles and responsibilities for sustainable practice. Moreover, knowledge and experience can be gained to shape "conflict-aware" engineers, specifically, who can recognize causal factors, acknowledge stakeholders and contribute to, if not lead, prevention and mediation efforts.

Preliminary observations in the classroom.
Considering all of the above – and the need to start somewhere – a preliminary module on conflict resolution was recently developed and piloted in two undergraduate courses at Virginia Tech. The first is a senior-level, required course within the mining engineering curriculum, which

■ Table 3

Description of conflict resolution module.

Component	Content
Reading and synthesis	Two academic papers that portray different conflict perspectives: inherently harmful and opportunistic. Students are asked to compare the two perspectives and to include their perceptions.
Lecture	Conflict theory is introduced, along with causal factors, the categories of need, and when/how ADR can be a useful conflict management tool.
Activity	A five participant role play, with four fictional characters from a specified work environment, and one group facilitator. Each student is assigned a particular role and is provided with their (but not other) character descriptions. All students are provided with a detailed description of the work environment and the conflict from their character's perspective. During the activity, groups are charged to resolve the conflict, which involves distributing "risks and rewards" amongst the characters (or the parties they represent). Students must communicate and advocate their position as their character; the role of the facilitator is to keep dialogue moving and reiterate the requirements for resolution. After one round of role play, groups are reset for a second round such that student's maintain their role but work with a different group. Students become familiar in the first round with the other characters (previously unknown to them), and they have the opportunity to use this "experience" as they work to resolve the conflict in the second round.
Reflective writing	Students are asked to explain how the module (in each of its components) impacted their prior knowledge and pre-conceived notions about conflict and to describe how conflict management skills may be useful in professional capacities.

broadly covers environmental management of mining projects (Class A). At present, this course (in addition to several others within the curriculum) contains significant focus on sustainable development in a broad sense (e.g., questioning the contributions of various practices or projects to sustainable development); but has not, until now included specific content on conflict management. Students in Class A typically have at least one practical work experience (i.e., either internship or co-op) in the mining, minerals processing or other related fields.

The second course selected for piloting is an introductory course offered widely across campus that focuses on energy resources, including their availability, present status in the United States and global portfolios, and environmental and social impacts of production and use (Class B). Although the majority of students enrolled in that course are majoring in an engineering discipline, there are no course pre-requisites, and thus no assumed baseline of foundational knowledge regarding sustainable development or conflict management. Students in Class B are likely to have a wide range of educational levels and prior work experiences and relatively few have experience specific to the extractive industries. While both courses have some aim to teach students to analyze critically certain aspects of non-renewable resource development, the first course is focused on practices while the second is more focused on principles.

The module contains a theoretical foundation and then real-world studies of conflict related to extractive resource projects. It begins with assigned reading and a formal lecture about social conflict, the various factors that motivate stakeholders to pursue it, and several common conflict management techniques including ADR. During the following class meeting, students have the opportunity to apply what they learned in their reading and previous lecture as they participate in a realistic conflict case study. The case involves three primary dimensions of conflict (i.e. psychological, procedural and substantive), and also touches upon the human interests of fairness, inclusion and honesty. Finally, the students are assigned to write a (guided) reflection on the above module components. Table 3 describes the content in the module.

Captured in the students' reflections are many takeaway points about their prior knowledge and conceptions of conflict management and their learning through the module. Students from both classes reported that the content (i.e., reading material and lecture) and role play activity were useful; observations from their reflections indicated that the module as a whole filled a real gap in students' knowledge. Students from Class A frequently explained that they had not realized the potential harm posed by unmanaged conflict and that they were not previously aware that alternatives to litigation might exist. But their writing clearly indicated that they understood relevant sustainable development principles at play, including the needs for stakeholder inclusiveness, transparent communication and fair processes. Furthermore, these students reported that the content helped enhance informal conflict management lessons that they already learned during practical work experience (i.e., mining/minerals related internship or co-op) or through social organizations/interactions. Overall, they attested that the pilot module was valuable. Their primary recommendations were to continue teaching the module, and some students even

▆ Table 4

Selected quotes from student reflections on the conflict resolution module.

Relevance	Class A	Class B
Preconceptions	• "…[The module] cleared a biased outlook I originally had about the subject. I believed that most conflict resolutions are one sided…" • "Before, I had always thought there was a clear-cut winner and loser. Additionally, I thought getting a third party outsider to help was something that was only done in a courtroom or for small children." • "Solutions to conflict are not cut and dry, and creative solutions are possible."	• "I always thought that conflict just has bad influences." • "…Prior to [the module], I only viewed conflict through a personal lens. I had never even thought of how to mediate an environmental conflict, and just how many stake holders were involved." • "Before this unit, my prior knowledge toward this topic was mostly that conflict was an unacceptable concept."
Awareness	• "The conflicts involved in the mining industry had not occurred to me." • "…it made me realize that conflict is probably going to happen at least once in my lifetime in the mining industry, and equipped me with an understanding of (hopefully) how my company and I can go about handling it in a constructive, respective (sic) and efficient way." • "Conflict stems from having different views and interests, which are part of a diverse society. The key is to make conflict a productive and not counterproductive situation."	• "Prior to the unit, I had some knowledge of ways to manage conflict. However, after the unit I feel like I can resolve any conflict that comes my way." • "I knew what conflict was but the many ways to resolve them was new to me. Also, there are many ways to escalate a conflict [that] I was unaware of." • "This unit taught me the importance of seeing conflict from the perspectives of all parties involved before taking action. I also learned that sometimes it is better to find resolution than being right."
Importance	• "The mining industry is constantly dealing with conflict due to its operations and procedures. By joining this industry, I am also choosing to join the fight towards solving these conflicts. In order to do so, I must understand conflict and be ready to use appropriate resolution management strategies." • "This will definitely be important for mining engineers in the future due to the historically controversial nature of the mining industry. With a background in conflict management, I will feel much more comfortable in the real world when a conflict arises." • "Conflicts can arise around the workplace whether it is in a boardroom or on site, [so] mining engineers should be prepared to meet conflict head on in order to build a productive and peaceful workplace."	• "The unit clearly outlined why every person should care about resolving or at least attempting to resolve conflict." • "I do believe that these lessons are relevant to not only future scientists and engineers, but to all professional fields because conflict is inevitable no matter what your profession is." • "I thought that the conflict resolution unit was useful in the professional field as well as in day-to-day life. Even if a person isn't going into engineering or mining, the tools and tips we received from the lecture can be transferred across many situations." • "I am confident that these lessons are relevant to future scientists and engineers. This is because most of the students in our class are engineering students and are definitely going be involved in a lot of team/group work in the future."

contributed specific ideas about how to expand it (e.g. additional role plays and opportunities to switch roles for existing role play).

The students in Class B also reflected on the meaningfulness of the module. In general, these students explained that they did not have much experience with social conflict in workplace environments, and therefore had never previously considered the value of successful conflict management. However, after understanding more about adverse financial and social effects caused by conflict, they drew clear links between conflict management strategies and outcomes. Most of the students in this class speculated that knowledge of conflict sources

and resolution options would be relevant to them in the future. Further, some students commented that they were appreciative of the opportunity that the module provided to learn about "real world things." Table 4 highlights some quotes from the submitted reflections about this module.

Across both classes, two main points can be made from the student reflections: while (1) students were generally unfamiliar with a range of conflict management strategies before the module, they (2) were able to quickly grasp basic information and apply their learning to a contextual problem. However, it is clear that the background and experience of the students played into their learning and conceptions of the

material presented in the module. The upper-level students (Class A) tended to reflect on and appreciate the relevance of the module to professional applications. They often related the material to their prior work experiences or, in some cases, their future work in mining or related fields. On the other hand, the students with a wider range of academic and practical experience (Class B), tended to reflect on the meaning of the module's lessons for interpersonal or generalized workplace relations. This suggests that, though both classes were able to synthesize the conflict management material and connect it to real situations, the experience level of students was important in terms of what sorts of situations they tended to consider.

In regards to the threshold concepts theory, observations from the pilot delivery of the modulem appear generally consistent with expectations. Students who already had some familiarity with sustainable development and their specific engineering field (i.e., mining) tended to be able to learn, apply and contemplate basic conflict management skills in their (future) professional domain. From the perspective of developing sustainability-minded and conflict-aware engineers, it is important to provide educational opportunities for students to build upon and refine their skillsets before professional practice – and so further integration of particular concepts and tools into curricula is ideal. Possible improvements to the conflict management module approach could range from provision of additional case studies to expansion of topical coverage to other required courses in the curriculum, and more deliberate connection to practical work experiences of students.

The path ahead

Conflict is a universal form of interaction in the human experience. While it is often perceived in negative light, conflict can result in desirable outcomes when effectively managed. Resolution of conflict surrounding extractive resource projects is becoming increasingly important for gaining and maintaining social license to operate. There are a variety of processes, including those that described as alternative dispute resolution processes, which may be used to manage conflict such that outcomes are more favorable than those reached through traditional litigious channels. However, these alternative channels cannot be pursued by industry practitioners if they are not known, or not appreciated.

Once the mineral industries successfully implement conflict management strategies as common practice, they will set a precedent for other business sectors to follow. Ultimately, such socially-conscious business practices could be the norm, not exception. Part of this cultural shift will require that the leaders of tomorrow have core competencies in both the technical and social domains.

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