When Mathematics Becomes Meaning

Toward a Holistic Epistemology in Education

Troy Shepherd, OCT, PhD

E-mail: troy.shepherd@alumni.utoronto.ca

Received June 2026
Accepted for publication September 2026
Published November 2026

Abstract

Contemporary education often privileges analytical and disciplinary forms of knowing while giving less attention to relational, integrative, and meaning-centered approaches to learning. This article explores Axiometaphorical Thinking as an emerging framework that bridges mathematical structure and metaphorical meaning through patterns of relational coherence. Situated within conversations on holistic education, Indigenous knowledge dialogue, systems thinking, and interdisciplinary learning, the paper examines how integrative epistemologies may contribute to more coherent understandings of knowledge, self, and world. Implications for curriculum, pedagogy, and learner development are considered.

Keywords: *two-eyed seeing, axiometaphorical thinking, transdisciplinary learning, mathematics, STEM*

The purpose of this paper is to introduce Axiometaphorical Thinking (AMT) as a holistic epistemological framework for education and to examine its potential to bring different ways of knowing into meaningful relationship. In particular, the paper considers how the axiomatic reasoning commonly associated with mathematics and science can coexist with metaphorical, relational, spiritual, and culturally situated ways of knowing without requiring one to be reduced to the other. Drawing on Indigenous, holistic, and transdisciplinary scholarship, the paper situates AMT within a broader movement toward epistemological pluralism and considers its implications for teaching, learning, and educational policy.

Many educators experience a split between scientific thinking and spiritual/holistic ways of knowing. This article proposes Axiometaphorical Thinking as a bridge that helps learners experience coherence rather than fragmentation. It explores the possibility that mathematics may function not only as a quantitative system, but also as a structural language of meaning-making. The field of mathematics is used as an example to connect to Axiometaphorical Thinking. Drawing from holistic education, interdisciplinary inquiry, and the emerging framework of Axiometaphorical Thinking, the paper examines how metaphor and mathematics may share underlying relational structures that support

integrative forms of understanding. In many educational contexts, scientific and holistic ways of knowing are treated as separate or incompatible domains, contributing to fragmentation in learners' intellectual and personal development. This article proposes that a more holistic epistemology—one that allows analytic, symbolic, relational, and experiential modes of knowing to coexist—may help restore coherence in education. Implications for whole-child learning, interdisciplinary teaching, and dialogue across knowledge systems are discussed.

The need for more integrative approaches to knowledge has been recognized internationally within scientific and educational discourse. The 1999 World Conference on Science, culminating in the UNESCO-ICSU Budapest Declaration on Science and the Use of Scientific Knowledge, called for greater dialogue between scientific knowledge and other knowledge systems, including traditional and Indigenous ways of knowing. The declaration acknowledged that contemporary global challenges cannot be addressed through disciplinary isolation or technological advancement alone, but require broader forms of ethical, cultural, and epistemological cooperation. The declaration conceded that modern science is not the only way of knowing and must make relationships with other traditional knowledges. Importantly, the declaration did not position scientific inquiry as incompatible with holistic or traditional knowledge systems. Rather, it emphasized the importance of mutual respect, dialogue, and shared responsibility in the pursuit of human well-being and sustainability. More than two decades later, education continues to grapple with how such dialogue might occur structurally within learning environments that often remain fragmented across disciplines, epistemologies, and ways of understanding human experience (UNESCO & ICSU, 1999).

Contemporary education exists within a paradox. Never before have learners had greater access to information, technological tools, and specialized knowledge, yet many students and educators report experiencing increasing fragmentation, disconnection, and loss of meaning within the educational process (Van Kessel & Den Heyer, 2025, para. 3). Miller 2011 holds, "the human world since the Industrial Revolution has stressed compartmentalization and standardization. The result has been fragmentation" (p. 3). Subjects are often taught as isolated domains, with mathematics separated from art, science separated from spirituality, and emotional or relational ways of knowing positioned outside the boundaries of legitimate academic inquiry. While this fragmentation has enabled remarkable specialization and scientific advancement, it has also contributed to a growing sense that education frequently struggles to address the whole human being.

The roots of reductionist education can be traced, in part, to the Cartesian separation of mind and matter, subject and object, which helped establish the foundations of modern scientific inquiry. While this distinction contributed significantly to the growth of analytic and empirical science, its continued treatment as a universal ontology may limit our capacity to address increasingly complex challenges. Ecological degradation, mental health fragmentation, and intercultural tensions reveal the limitations of approaches that separate humans from nature, cognition from emotion, and observer from observed. In contrast, Indigenous and African scholars have emphasized that knowledge emerges through relationships, lived experience, and interconnectedness rather than through isolated categories alone (Battiste, 2002; Cajete, 2000; Wane, 2005), suggesting that educational systems may benefit from more holistic approaches that

recognize the relational nature of reality.

Rather than emphasizing fixed categories, Indigenous knowledge systems often foreground interdependence, relationship, and the interconnected nature of all phenomena. This relational orientation is reflected in Wagamese's (2019) assertion that humanity shares a common spiritual journey rooted in our interconnectedness and in Four Arrows' (2016) argument that Indigenous worldviews are grounded in kinship, participation, and reciprocal relationships with the living world.

When modern Western epistemology is presented through schooling as though it were culturally neutral and universally applicable, learners whose understandings of reality are grounded in relationship, interconnectedness, and lived experience may encounter profound forms of epistemic dissonance. The challenge is therefore not merely pedagogical but concerns deeper questions of being, knowing, and valuing, inviting educators to explore how analytical and relational ways of knowing might coexist within a more holistic vision of education that honors humanity's interconnectedness (Wagamese, 2019) and the principle of learning to see with the strengths of multiple knowledge systems simultaneously through Two-Eyed Seeing (Hatcher et al., 2009). How might education create spaces where analytic and relational modes of knowing can coexist without one being positioned hierarchically?

In many classrooms, knowledge is implicitly organized according to divisions that mirror broader cultural assumptions. Scientific reasoning is often framed as objective, analytical, and measurable, while holistic, intuitive, symbolic, and relational forms of understanding are treated as subjective or secondary. Students may learn to navigate these domains separately rather than integratively. As a result, learners are frequently required to compartmentalize aspects of themselves: intellect becomes disconnected from emotion, cognition from embodiment, and academic achievement from existential meaning. The educational experience can therefore become one of adaptation to fragmentation rather than participation in purpose, meaning and coherence.

This challenge extends beyond curriculum organization. Increasingly, educators are encountering students who struggle not merely with academic performance, but with motivation, belonging, anxiety, and a diminished sense of purpose (Malin, 2018). Discussions regarding whole-child education, social-emotional learning, transdisciplinary teaching, and culturally inherent pedagogy all reflect, in different ways, an emerging recognition that human learning cannot be solely reductionist. Learners seek connection, relevance, and meaning alongside conceptual understanding. Yet many educational systems continue to privilege forms of knowing that emphasize abstraction and standardization while marginalizing relational and integrative dimensions of human experience.

At the same time, important conversations are emerging across disciplines regarding the limitations of strictly reductionistic frameworks. Holistic education scholars, Indigenous educators, systems theorists, contemplative researchers, and interdisciplinary thinkers have increasingly argued that knowledge is relational rather than isolated, participatory rather than purely detached, and contextual rather than entirely objective (Blenkinsop & Raymond, 2023). These perspectives do not reject scientific inquiry; rather, they question whether dominant educational paradigms sufficiently account for

the complexity and interconnectedness of human knowing. The challenge, therefore, is not simply to oppose scientific and holistic perspectives, but to explore whether more integrative epistemological models are possible.

Within this context, mathematics occupies a particularly interesting position. Often regarded as the most objective and universal of disciplines, mathematics is typically understood as a language of quantity, logic, and measurement. Yet mathematics also functions symbolically, relationally, and structurally (Hersh, 2005). Mathematical patterns shape music, art, architecture, ecological systems, and scientific theory. Metaphor similarly operates through relationships, patterns, and structural correspondences that allow meaning to emerge across domains of experience. Despite this potential overlap, mathematics and metaphor are rarely explored together within educational discourse as complementary modes of meaning-making.

This article proposes that educational fragmentation may partly stem from the absence of frameworks capable of structurally bridging analytic and holistic ways of knowing. Drawing from the emerging framework of Axiometaphorical Thinking, the discussion explores the possibility that mathematics may function not only as a quantitative language, but also as a relational structure capable of supporting integrative understanding across disciplines and epistemologies (Shepherd, 2025). Rather than positioning science and holistic knowledge as oppositional, this approach seeks to investigate whether structural relationships themselves may provide common ground for dialogue, coherence, and educational meaning-making. What if mathematics could function not only as a quantitative language, but also as a structural bridge for meaning-making across domains of knowledge?

Holistic Education and Epistemology

Situating the Need for Integrative Knowing Within Educational Discourse

The call for more integrative, relational, and holistic forms of knowing in education is not new. Across diverse intellectual traditions, scholars, educators, philosophers, and knowledge keepers have increasingly questioned the fragmentation produced by modern educational systems and the epistemological assumptions inherited from Cartesian dualism and positivist science. Indigenous scholars have challenged the assumption that Cartesian dualism represents a universal framework for understanding reality. Little Bear (2000), Ermine (2007), and Battiste (2002) contend that many Indigenous knowledge systems are grounded in relational ontologies that do not sharply separate mind from matter, subject from object, or humanity from nature. Consequently, educational systems founded upon dualistic epistemologies may create tensions for learners whose worldviews are rooted in interconnected and relational understandings of reality.

Research in science education suggests that students whose home cultures embody worldviews different from those assumed by Western schooling may experience learning as a form of cultural border crossing rather than a straightforward acquisition of knowledge (Aikenhead, 1996). Similarly, Jegede's (1995) theory of collateral learning and Costa's (1995) continuum of student responses to school science indicate that dissonance occurs when learners are required to navigate between relational, culturally grounded ways of knowing and the dualistic

assumptions embedded within conventional educational frameworks.

While the modern Western scientific paradigm generated extraordinary technological and analytic advances, many thinkers have argued that its reductionist tendencies have also contributed to forms of disconnection: between mind and body, human and nature, reason and emotion, science and spirit, and ultimately, between learners and meaning itself. The growing discourse surrounding integrative knowing reflects a recognition that contemporary educational challenges may require more relational and multidimensional approaches to knowledge, learning, and human development.

A growing body of scholarship has challenged the fragmentation that characterizes much of modern education. hooks (2014) critiqued the mechanistic and disembodied nature of conventional schooling, arguing instead for an engaged pedagogy that recognizes the emotional, spiritual, intellectual, and communal dimensions of human development. Similarly, Palmer (2017) argued that modern education often separates knowledge from identity, encouraging learners and educators to disconnect from their inner lives in order to conform to impersonal institutional structures. For Palmer, authentic education emerges through connectedness, selfhood, and the recognition that "we teach who we are." These concerns resonate strongly with the work of Bohm (1980), who argued that fragmentation is not simply a feature of educational systems but a pervasive habit of thought that divides reality into isolated parts. In contrast, Bohm proposed that deeper understanding emerges through perceiving relationships, patterns, and underlying coherence, emphasizing dialogue as a process of shared meaning-making. Taken together, the work of hooks, Palmer, and Bohm suggests that meaningful education requires moving beyond reductionist separations toward more holistic approaches that reconnect knowledge with relationship, identity, community, and the larger wholeness of which learners are a part.

Within educational discourse specifically, Montessori (1948) articulated many of these concerns decades earlier through her concept of "cosmic education." Montessori argued that education should help learners perceive the interconnectedness of all things and situate themselves within a larger living cosmos. Rather than organizing knowledge into isolated disciplines disconnected from lived meaning, Montessori envisioned education as fostering wonder, relational awareness, ethical responsibility, and holistic understanding. Her educational philosophy emphasized that intellectual development cannot be separated from spiritual, emotional, moral, and ecological dimensions of life. In this sense, Montessori education represents an early challenge to overly reductionist models of schooling and aligns with broader calls for integrative educational paradigms.

The need for epistemological plurality has also been strongly articulated within Indigenous and anti/post/decolonial scholarship. Battiste, for example, has extensively critiqued the cognitive imperialism embedded within Western educational systems, particularly in their treatment of Indigenous knowledge systems. Battiste argues that Eurocentric education has historically positioned Western scientific epistemologies as universal, neutral, and superior while marginalizing relational, spiritual, land-based, and communal ways of knowing (Battiste, 2013). She emphasizes that decolonizing education requires more than superficial inclusion of Indigenous content; it requires confronting the epistemological assumptions that define what counts as legitimate knowledge. Battiste's work highlights the

importance of cognitive justice and epistemic diversity within educational systems increasingly shaped by multicultural and global realities.

Drawing on African philosophical traditions, Naudé (2017), drawing on Mbiti (1969), notes that many Indigenous and African understandings of personhood emphasize relationality, wherein individuals are constituted through their relationships with others rather than existing as isolated, autonomous entities. Although he cautions against simplistic binaries that portray African thought as purely communal and Western thought as purely individualistic, he nevertheless argues that relational conceptions of human existence offer an important corrective to fragmented and atomistic understandings of reality that continue to shape contemporary education and knowledge production.

Related concerns emerge in the work of Odora Hoppers (2002), who argues that contemporary educational systems remain deeply shaped by colonial knowledge hierarchies that exclude or subordinate Indigenous and traditional epistemologies. Odora Hoppers advocates for "inclusive knowledge systems" capable of fostering dialogue between Western scientific paradigms and Indigenous ways of knowing without reducing one to the other. Importantly, she does not reject modern science outright but calls for broader epistemological frameworks capable of addressing ecological, ethical, and civilizational crises that reductionist approaches alone have struggled to resolve (Odora Hoppers, 2002). Her work reflects a growing recognition that humanity's most pressing challenges may require forms of knowledge integration that transcend inherited disciplinary and cultural boundaries.

These two scholars refer to the principles articulated in the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP), particularly regarding the rights of Indigenous peoples to maintain, revitalize, and transmit their epistemologies, pedagogies, languages, and cultural traditions through education. UNDRIP challenges educational systems that universalize Western knowledge frameworks while marginalizing Indigenous ways of knowing as supplementary, symbolic, or non-scientific. In the context of STEM education, this raises important questions about the epistemological assumptions embedded within curriculum, pedagogy, and conceptions of valid knowledge itself. When educational systems privilege only reductionist and decontextualized forms of reasoning, students from relational and holistic worldviews may experience forms of epistemic dislocation and cultural fragmentation. Responding meaningfully to UNDRIP, therefore, may require more than the inclusion of Indigenous content within existing structures; it may also require the creation of educational spaces where multiple epistemologies can enter into genuine dialogue without one being positioned as inherently superior to the other. From this perspective, integrative approaches to knowing are not simply pedagogical innovations, but part of a broader movement toward epistemic justice, reconciliation, and educational pluralism.

Taken together, these thinkers and movements reveal a growing educational conversation centered on overcoming fragmentation and recovering more integrative forms of understanding. Although they emerge from different intellectual, cultural, and disciplinary traditions, they share several common concerns: the reduction of human experience to narrowly analytic frameworks, the separation of knowledge from meaning and relationship, and the marginalization of holistic, relational, Indigenous, spiritual, or embodied ways of knowing. Importantly, these scholars do not reject analytic reasoning or scientific inquiry themselves. Rather, they challenge the exclusivity

of epistemological frameworks that treat reductionist modes of thought as the sole legitimate pathway to truth.

It is within this broader discourse that integrative frameworks such as Axiometaphorical Thinking may be situated. The purpose is not to replace science with spirituality, nor to dissolve distinctions between different knowledge systems, but to explore whether new
forms of representational and epistemic integration may help bridge ways of knowing that increasingly appear incommensurable. Smith (2013) asserts, "the values, attitudes, concepts and language embedded in beliefs about spirituality represent, in many cases, the clearest contrast and mark of difference between indigenous peoples and the West" (p. 97). In this sense, the search for integrative knowing is not an isolated intellectual project, but part of a wider transdisciplinary and transcultural effort to rethink the nature of knowledge, learning, and human flourishing in the twenty-first century.

Axiometaphorical Thinking as a Structural Bridge

Ermine (2007) argues that the Ethical Space invites dialogue between Western and Indigenous traditions without requiring either to surrender its integrity, offering a framework for educational approaches that seek to bridge analytic and relational modes of knowing. Axiometaphorical Thinking emerges from this Ethical Space. Through a simple but potentially significant observation: both mathematics and metaphor operate through structure and relationships. Although these domains are typically treated as fundamentally different—one associated with quantitative precision and the other with symbolic or poetic expression—both rely upon structural correspondences that generate meaning through comparison, relation, and pattern. Mathematics organizes relationships numerically and logically, while metaphor organizes relationships symbolically and conceptually. In both cases, meaning does not arise from isolated entities alone, but from the relational structures connecting them. Wilson (2008) argues that Indigenous ontology and epistemology are united through the principle of relationality. This emphasis on relationships rather than isolated objects resonates with Axiometaphorical approaches that seek coherence across apparently distinct domains of knowledge through patterns of structural correspondence.

Axiometaphorical Thinking (AMT) emerged from the proposition that axioms and metaphors are structurally equivalent forms of meaning-making, with the mathematical expression "A = B" corresponding to the metaphorical expression "A is B" (Shepherd, 2025). By recognizing this structural correspondence, AMT offers a framework for bridging reductionist and holistic epistemologies, creating an ethical space in which scientific, Indigenous, and spiritual ways of knowing can coexist without requiring the erasure of difference (Shepherd, 2025).

The word axiometaphor is a combination of the words axiom and metaphor. An axiom is a self-evident truth. It is a fundamental statement or principle in a system of knowledge or logic accepted as truth without requiring proof. In mathematics, logic, and philosophy, axioms are building blocks for deriving further reasoning. Other truths can be generated from basic axioms. Axioms are frequently simple statements. An example from arithmetic is 1 = 1. It is a simple, self-evident statement, used to derive other truths like 2 = 2, 3 = 3... ∞ = ∞. As such, the axiom may be generalized in the form _____ =_____. In this

form, we may see that the axiom and the metaphor share the same structure.

Metaphors are figures of speech which can be written in the form __is__. An example of a famous metaphor in English is "All the world is a stage." When we look at both forms, they both have blanks. The axiom uses the '=' sign, while the metaphor uses the word is. The word is and = are synonyms. Since we may say one plus one is two. Or we may say one plus one = two. Both statements have the same meaning. This proves that the axiom and the metaphor are the same, generating the term 'axiometaphor.'

Different systems of logic use different axiometaphors. Some cultures say that 'The Earth is alive.' From a Western scientific perspective, this may be sensed as a metaphor that may be dismissed as poetry. However, from an Earth ways perspective, it is considered an axiomatic, literal truth from which further reasoning is derived. The axiometaphor is a 'theory' in that it can be used to explain similarities between mathematical and metaphysical truths.

At its most basic level, mathematics is not merely a collection of numbers or procedures. It is a system for describing relationships. Equations express correspondences between quantities, variables, and operations. Geometry explores relationships between forms in space. Algebra investigates patterns and transformations. Even arithmetic depends upon relational understanding: addition, subtraction, equality, proportion, and ratio all derive meaning through connections between entities rather than through isolated objects alone.

The equation 1=1 is a basic axiom in arithmetic. In geometry a line may be viewed as a metaphor. For example, a line has zero with. This means we cannot observe a line.
We may define it: A line is the shortest distance between two points. In this definition, we see the structure of a metaphor ____ is ____.

Metaphor functions similarly as axioms. As such, it is a matter of cultural perspective or perception whether a truth is considered an axiom or a metaphor. Western culture may view Indigenous axioms as metaphors and Indigenous cultures may view Western axioms as metaphors as well. Axiometaphorical Theory allows a third space for cross-cultural dialogue where both cultures' axioms are considered as foundational statements for further reasoning. When both are viewed as true, this allows for meaningful cross-cultural dialogue.

Axiometaphorical Thinking proposes that these two modes of relational organization may be more deeply connected than educational systems often acknowledge. Mathematics and metaphor both involve acts of abstraction, representation, and structural mapping. Each creates systems through which human beings organize experience, identify patterns, and generate meaning. While mathematics is generally framed as objective and metaphor as subjective, both rely upon symbolic structures that mediate human understanding of reality.

This perspective suggests that metaphor and mathematical structures may be viewed as identical and that mathematical equations may be interpreted objectively or spiritually. If we consider the number 1 can be represented as infinite infinitesimals, then each infinitesimal part of the universe may be considered different from another. This would mean that nothing is identical to anything else. Alternatively, we may see the one infinite multiverse as one unit where all is the same in the everythingness of Creation.

Mathematically, all numbers are of the number 1. As such, what is considered identical and different is a matter of perspective.

If mathematical and metaphorical ways are considered separate, then Axiometaphorical Thinking proposes that relational structure itself may function as a bridge between analytic and holistic modes of knowing. Mathematics provides rigor, consistency, and formal precision. Metaphor provides contextual meaning, experiential resonance, and conceptual flexibility. Together, they may offer complementary pathways for integrative understanding.

One way to approach this idea is through the concept of structural equivalence. Structural equivalence refers to situations in which different forms or domains share similar relational patterns despite differing in content or appearance. For example, the mathematical equation "1 = 1" expresses a relationship of identity and equivalence. Within mathematics, this statement indicates that a quantity is equal to itself. Yet structurally, similar forms of identity also appear linguistically and philosophically. Statements such as "a person is themselves" or "life is life" similarly invoke forms of identity, coherence, or self-relation. Human cognition repeatedly uses relational structures to organize meaning across domains.

This becomes particularly significant educationally because learners often move naturally between symbolic, mathematical, emotional, and metaphorical forms of understanding. Young children routinely use imaginative comparison to make sense of abstract ideas. Scientific models themselves frequently depend upon metaphorical language: electrical "flow," genetic "codes," gravitational "fields," and evolutionary "trees" all involve metaphorical structures that help organize complex phenomena. Even advanced mathematics relies heavily on symbolic representation and abstraction that extend beyond direct sensory experience.

Yet educational systems often present mathematics as detached from meaning rather than as a participatory language of relational understanding. Students may learn procedures without perceiving underlying patterns or connections to lived experience. As a result, mathematics can become associated with memorization and performance rather than curiosity, imagination, or coherence. Axiometaphorical Thinking attempts to reopen the possibility that mathematics may function not only computationally, but also epistemologically—as a way of perceiving relationships within and across domains of experience.

Importantly, this framework does not reject analytical rigor. It depends upon careful attention to structure, consistency, and relational integrity. However, it also recognizes that human understanding is rarely produced through analysis alone. Meaning emerges when relationships become coherent across multiple levels of experience: conceptual, emotional, symbolic, embodied, and relational. In this sense, coherence itself becomes epistemologically significant. Another example of this is that the English word 'a' is equal in quantity to the number 1. If I ask for a pen, it is the same quantity as asking for 1 pen. Axiometaphorically, 1= a.

Bohm, 1980, suggested that fragmentation occurs when thought mistakes its abstractions for independently existing realities disconnected from larger wholes. Axiometaphorical Thinking resonates with this concern by proposing that relational structures may help reconnect domains of knowledge that educational systems often separate. Rather than reducing one domain into another, the goal is to create conditions under

which multiple modes of understanding can interact coherently without collapsing into relativism or confusion.

For example, consider how learners encounter patterns in both mathematics and music. Rhythm involves ratio, repetition, proportion, timing, and relational sequencing. Musical harmony depends upon mathematical frequencies and relationships, yet music also evokes emotional and symbolic meaning that exceeds numerical description alone. A purely reductionistic account may explain frequencies while neglecting lived experience; a purely subjective account may celebrate emotional resonance without recognizing structural organization. An integrative approach allows both dimensions to coexist without requiring one to eliminate the other.

Similarly, ecological systems can be understood scientifically through measurable interactions, but they are also experienced relationally, ethically, aesthetically, and culturally. Indigenous knowledge systems frequently emphasize these relational dimensions without abandoning careful observation or practical knowledge. Axiometaphorical Thinking therefore explores whether symbolic and mathematical structures might help facilitate dialogue across differing epistemologies by focusing attention on relational coherence rather than rigid categorical separation.

Educationally, this approach may encourage learners to perceive knowledge as isolated content as well as interconnected patterns of relationship. Mathematics becomes calculation and connection; metaphor becomes literary and literal. Axiometaphorically, metaphors = figures of speech. Both become participatory tools through which human beings organize meaning, navigate complexity, and seek coherence within experience.

In this sense, Axiometaphorical Thinking is not primarily concerned with replacing existing disciplines or educational structures. Rather, it asks whether relational coherence itself may constitute an overlooked dimension of learning—one capable of supporting dialogue between analytic precision and holistic understanding in ways that are intellectually rigorous, educationally meaningful, and humanly relevant.

Educational Implications

If contemporary educational challenges are rooted partly in fragmentation and the separation of knowledge from lived experience, then approaches that cultivate relational and integrative forms of knowing may become increasingly important. Axiometaphorical Thinking offers one possible response by deepening the ethical space for dialogue among diverse knowledge traditions, supporting metaphoric blending across cultural domains (Atleo, 2009), and fostering epistemological pluralism through an ecology of knowledges (de Sousa Santos, 2014).

If education is understood not merely as the transmission of information but as the cultivation of meaningful understanding, then the implications of integrative epistemological frameworks become significant for classroom practice. While Axiometaphorical Thinking remains exploratory, its emphasis on relational coherence aligns with emerging perspectives that view knowledge as relational and interconnected rather than isolated and discrete (Barad, 2007), while also resonating with transdisciplinary approaches that seek dialogue across diverse ways of knowing in response to complex human challenges (Nicolescu, 2008). As such, AMT

offers a potential framework for teaching, curriculum design, and learner development that supports integrative forms of meaning-making across educational contexts.

One immediate implication concerns interdisciplinary learning. In many schools, subjects are divided into distinct categories with limited structural connection between them. Mathematics is taught separately from literature, science separately from art, and emotional development separately from academic inquiry. Although disciplinary specialization has important advantages, students often struggle to perceive how knowledge connects meaningfully across domains. Learning can therefore become fragmented into disconnected units of information rather than experienced as an interconnected process of understanding.

Axiometaphorical Thinking suggests that relational structures may provide one way of supporting interdisciplinary coherence without erasing disciplinary differences. For example, patterns, symmetry, proportion, transformation, balance, rhythm, and equivalence appear across mathematics, music, visual art, ecology, literature, and social systems. Helping students identify these recurring relational structures may strengthen their ability to transfer understanding across contexts rather than treating knowledge as isolated content to be memorized temporarily for testing. Interdisciplinary learning, from this perspective, becomes less about superficially combining subjects and more about helping learners recognize underlying patterns of relationship across domains.

Such an approach may also support forms of whole-child education that seek to integrate cognitive, emotional, social, ethical, and imaginative dimensions of learning. Contemporary educational discourse increasingly acknowledges that human beings do not learn solely through detached cognition. Emotion, identity, belonging, embodiment, imagination, and meaning all influence attention, memory, motivation, and understanding. Yet many classrooms still prioritize forms of instruction that emphasize procedural performance over relational engagement.

By recognizing metaphor and symbolic meaning-making as legitimate components of understanding rather than distractions from "real" learning, educators may create conditions that support deeper learner participation. Mathematical concepts, for example, can be explored not only procedurally but relationally. A discussion of balance in algebra may connect conceptually to balance within ecological systems, social relationships, or artistic composition. Such connections do not replace formal mathematical instruction; rather, they situate mathematical reasoning within broader contexts of human meaning-making. Learners may therefore encounter knowledge as something lived and interconnected rather than merely external and abstract.

This integrative orientation may also help bridge longstanding divisions between STEM disciplines and the humanities. Educational systems frequently position scientific and technical fields as fundamentally separate from artistic, philosophical, or reflective inquiry. However, many contemporary challenges—including ecological crises, technological ethics, artificial intelligence, and cultural polarization—require forms of reasoning that extend beyond disciplinary silos. Technical expertise alone cannot resolve questions involving meaning, ethics, identity, or collective responsibility. Separating STEM from the humanities is like separating the discreteness of the number 1 from its wholeness.

Axiometaphorical Thinking proposes that structural and relational reasoning may offer shared ground between these domains. Scientific inquiry relies upon pattern recognition, abstraction, modeling, and symbolic representation, while the humanities explore interpretation, metaphor, narrative, ethics, and lived meaning. Rather than opposing these approaches, integrative educational models may help students move fluidly between analytic precision and interpretive understanding depending upon the demands of a situation. Such flexibility may become increasingly important within rapidly changing social and technological contexts.

The framework may also hold relevance for conversations surrounding Indigenous and scientific dialogue within education. In many colonial educational systems, Indigenous knowledge traditions have historically been marginalized or treated as culturally interesting but epistemologically secondary to Western scientific frameworks. Increasingly, however, educators and scholars have called for approaches that support respectful engagement across knowledge systems without reducing one into the other.

Within this context, relational coherence may offer a useful orientation. Many Indigenous epistemologies emphasize interconnectedness, relational accountability, participation, and the inseparability of knowledge from lived relationships with community, land, and spirit. Scientific inquiry, meanwhile, offers powerful tools for systematic observation, analysis, and empirical investigation. Axiometaphorical Thinking does not claim to resolve tensions between these traditions, nor should it be used to appropriate or homogenize distinct knowledge systems. However, by focusing attention on structural relationships and relational meaning-making, it may contribute to educational spaces where dialogue becomes more possible without demanding epistemological hierarchy.

At the classroom level, one of the most practical implications may involve meaning-making itself. Many students experience academic learning as disconnected from personal relevance or existential significance. Questions such as “Why does this matter?” frequently emerge when learners encounter content as isolated information rather than as part of larger patterns of understanding. Integrative approaches may help address this issue by encouraging students to explore how ideas connect symbolically, relationally, historically, emotionally, and practically across contexts.

For instance, rather than teaching metaphor exclusively within language arts, educators might examine how metaphor shapes scientific models, political discourse, social identity, and mathematical thinking. Similarly, mathematics may be explored not only as procedural calculation but also as a language of relationships present within music, architecture, ecological systems, and artistic design. Such approaches may deepen engagement by allowing students to perceive coherence between academic content and lived experience.

These implications also relate closely to the concept of representational flexibility—the capacity to move between different modes of representation, interpretation, and understanding depending on context. Complex problems often require learners to navigate multiple frameworks simultaneously: numerical, visual, symbolic, emotional, linguistic, scientific, ethical, and relational. Educational systems that privilege only one representational mode may unintentionally limit students’ ability to think adaptively and integratively.

Axiometaphorical Thinking encourages learners to recognize that meaning can emerge through multiple forms of representation without collapsing all distinctions between them. A graph, a story, an equation, a metaphor, and a scientific model each organize experience differently while potentially illuminating shared relational patterns. Representational flexibility therefore becomes not simply a cognitive skill, but an epistemological capacity for navigating complexity with both rigor and openness.

Ultimately, the educational implications of this framework remain provisional and exploratory. More theoretical refinement and empirical research would be necessary to evaluate its effectiveness within actual educational settings. Nevertheless, the broader implication remains important: educational coherence may depend not only upon what students know, but upon their capacity to perceive meaningful relationships across domains of knowledge, experience, and human understanding.

Conclusion

The challenges facing contemporary education are not solely curricular or technological; they are also epistemological. Questions concerning fragmentation, meaning, belonging, and coherence increasingly point toward deeper issues regarding how knowledge itself is understood, organized, and experienced within educational systems. While disciplinary specialization has contributed enormously to scientific and intellectual advancement, many learners continue to encounter education as divided into disconnected categories that struggle to address the fullness of human experience.

This article has explored the possibility that relational structure may offer one pathway toward greater educational coherence. Drawing from holistic education discourse and the emerging framework of Axiometaphorical Thinking, the discussion has suggested that mathematics and metaphor may share important relational qualities that support integrative forms of meaning-making. Rather than viewing mathematics solely as a computational tool or metaphor solely as literary expression, this perspective invites consideration of how symbolic structures themselves participate in the organization of human understanding across domains.

Importantly, this inquiry remains exploratory. Axiometaphorical Thinking is not presented here as a completed system or universal solution to educational fragmentation. Many conceptual, philosophical, and pedagogical questions remain open. Further theoretical clarification, interdisciplinary dialogue, and empirical research would be necessary to better understand both the possibilities and limitations of this framework within educational contexts. Caution is especially important when engaging questions involving spirituality, epistemology, and cross-cultural knowledge systems, where oversimplification can easily occur.

At the same time, the growing interest in whole-child education (Lewallen et al., 2015), post-materialist science (Kuhn, 1962), interdisciplinary learning and systems thinking (Bai et al., 2023), contemplative education (Roeser & Peck, 2009), and Indigenous knowledge dialogue (Battiste, 2001; Yip & Chakma, 2024) suggests that many educators are already searching for more integrative ways of understanding learning and human development. The present discussion seeks to participate modestly within this broader conversation by proposing that relational coherence itself may deserve greater educational attention.

Perhaps one of the central questions facing

education today is not simply how learners acquire information, but how they learn to perceive meaningful relationships—between disciplines, between self and world, between analysis and experience, and between different ways of knowing. If fragmentation is partly a crisis of disconnected meaning, then educational coherence may involve more than curricular reform alone. It may require new ways of perceiving the relationship itself.

Whether mathematics can function not only quantitatively but also relationally and symbolically within this process remains an open question worthy of continued inquiry. Yet even asking such questions may help create educational spaces where analytic rigor and holistic understanding are no longer treated as opposing possibilities, but as complementary dimensions of human learning.

The implications of this work extend beyond individual classrooms to broader educational policy. International organizations such as UNESCO have increasingly called for approaches to STEM education that respond not only to scientific and technological change, but also to the cultural, ethical, and ecological challenges facing humanity. Such directions invite educators and policymakers to reconsider what counts as legitimate knowledge within STEM and how scientific knowledge might enter into meaningful dialogue with Indigenous, traditional, spiritual, and other ways of knowing. Axiometaphorical Thinking (AMT) offers one possible response to this challenge by providing a conceptual framework through which learners can hold different epistemological perspectives in relationship without requiring one to be reduced to, or validated by, another. At the policy level, this suggests that STEM education need not be framed solely around disciplinary knowledge and technical competence, but can also cultivate epistemic flexibility, relationality, and the capacity to engage respectfully across knowledge systems. In this sense, AMT may contribute to emerging international efforts to imagine STEM education as not simply preparation for a technological future, but as part of the larger task of educating learners to navigate an increasingly complex, pluralistic, and interconnected world.

Disclosure of Generative AI Use

Generative AI was used during the preparation of this manuscript as an editorial and writing-support tool, including assistance with refining language, improving clarity and organization, and exploring alternative ways of expressing and connecting the author's ideas. The author retains responsibility for the conceptual framework, scholarly argument, interpretation of sources, accuracy of the manuscript, and its final content.

References

Aikenhead, G. S. (1996). Science education: Border crossing into the subculture of science. *Studies in Science Education, 27*(1), 1–52. https://doi.org/10.1080/03057269608560077

Atleo, M. R. (2009). Understanding Aboriginal learning ideology through storywork with Elders. *Alberta Journal of Educational Research, 55*(4), 453–467. https://doi.org/10.55016/ojs/ajer.v55i4.55339

Bai, H., Anderson, L., & Scott, C. (2023). Contemplation as a quintessential educational project for our times. *Holistic Education Review, 3*(2). https://her.journals.publicknowledgeproject.org/index.php/her/article/view/2978

Barad, K. (2007). *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*. Duke University Press.

Battiste, M. (2001). *Indigenous knowledge and pedagogy in First Nations education: A literature review with recommendations*. National Working Group on Education.

Battiste, M. (2013). *Decolonizing education: Nourishing the learning spirit*. Purich Publishing.

Blenkinsop, S., & Raymond, J. S. (2023). *Introducing holistic education: The language of community and wholeness*. Routledge.

Bohm, D. (1980). *Wholeness and the implicate order*. Routledge & Kegan Paul.

Cajete, G. (2000). *Native science: Natural laws of interdependence*. Clear Light Publishers.

Costa, V. B. (1995). When science is "another world": Relationships between worlds of family, friends, school, and science. *Science Education, 79*(3), 313–333. https://doi.org/10.1002/sce.3730790306

de Sousa Santos, B. (2014). *Epistemologies of the South: Justice against epistemicide*. Paradigm Publishers. https://doi.org/10.4324/9781315634876

Ermine, W. (2007). The ethical space of engagement. *Indigenous Law Journal, 6*(1), 193–203.

Four Arrows. (2016). *Point of departure: Returning to our more authentic worldview for education and survival*. Information Age Publishing.

Hatcher, A., Bartlett, C., Marshall, A., & Marshall, M. (2009). Two-Eyed Seeing in the classroom environment: Concepts, approaches, and challenges. *Canadian Journal of Science, Mathematics and Technology Education, 9*(3), 141–153. https://doi.org/10.1080/14926150903118342

Hersh, R. (2005). Reconceptualizing mathematics as a humanistic discipline. *PRIMUS, 15*(3), 193–208.

hooks, b. (2014). *Teaching to transgress: Education as the practice of freedom*. Routledge.

Jegede, O. J. (1995). Collateral learning and the eco-cultural paradigm in science and mathematics education in Africa. *Studies in Science Education, 25*(1), 97–137. https://doi.org/10.1080/03057269508560051

Kuhn, T. S. (1962). *The structure of scientific revolutions*. University of Chicago Press.

Le Grange, L. (2018). Decolonising, Africanising, indigenising, and internationalising curriculum studies: Opportunities to (re)imagine the field. *Journal of Education, 74*, 4–18. https://doi.org/10.17159/2520-9868/i74a01

Lewallen, T. C., Hunt, H., Potts-Datema, W., Zaza, S., & Giles, W. (2015). The Whole School, Whole Community, Whole Child model: A new approach for improving educational attainment and healthy development for students. *Journal of School Health, 85*(11), 729–739. https://doi.org/10.1111/josh.12310

Little Bear, L. (2000). Jagged worldviews colliding. In M. Battiste (Ed.), *Reclaiming Indigenous voice and vision* (pp. 77–85). UBC Press.

Malin, H. (2018). *Teaching for purpose: Preparing students for lives of meaning*. Harvard Education Press.

Miller, J. P. (2007). *The holistic curriculum* (2nd ed.). University of Toronto Press.

Montessori, M. (1948). *To educate the human potential*. Kalakshetra Publications.

Naudé, P. (2017). *Decolonising knowledge: In what sense is an 'African' ethic possible?* [Inaugural address]. University of

Stellenbosch Business School, Stellenbosch University.

Nicolescu, B. (2008). *Transdisciplinarity: Theory and practice*. Hampton Press.

Odora Hoppers, C. A. (Ed.). (2002). *Indigenous knowledge and the integration of knowledge systems: Towards a philosophy of articulation*. New Africa Books.

Roeser, R. W., & Peck, S. C. (2009). An education in awareness: Self, motivation, and self-regulation in contemplative perspective. *Educational Psychologist, 44*(2), 119-136. https://doi.org/10.1080/00461520902832350

Shepherd, T. H. (2025). *Deepening dialogue between Indigenous and Western ways of knowing: Re-spiriting K-12 STEM education in Ontario* [Doctoral dissertation, University of Toronto].

Smith, L. T. (2012). *Decolonizing methodologies: Research and Indigenous peoples* (2nd ed.). Zed Books.

United Nations Educational, Scientific and Cultural Organization, & International Council for Science. (1999). *Declaration on science and the use of scientific knowledge*. UNESCO Digital Library. https://unesdoc.unesco.org/ark:/48223/pf0000116994

Van Kessel, C., & Den Heyer, K. (2025). From fragmentation to integration: Designing coherent blended learning environments in higher education. *Computers and Education Open, 8*, Article 100215.

Wagamese, R. (2019). *Embers: One Ojibway's meditations*. Douglas & McIntyre.

Wane, N. N. (2005). African Indigenous knowledge: Claiming, writing, storing, and sharing the discourse. *Journal of Thought, 40*(2), 27–46.

Wilson, S. (2008). *Research is ceremony: Indigenous research methods*. Fernwood Publishing.

Yip, S. Y., & Chakma, U. (2024). The teaching of Indigenous knowledge and perspectives in initial teacher education: A scoping review of empirical studies. *Journal of Further and Higher Education, 48*(3), 287-300. https://doi.org/10.1080/0309877x.2024.2327029

Author Bio

Troy Shepherd, PhD, is an Ontario Certified Teacher with over two decades of experience in education and a researcher exploring the intersections of modern scientific and Earth Ways of Knowing. He holds a PhD from the University of Toronto (2025), where his research examined how dialogue between these knowledge traditions can re-spirit K–12 STEM education. He is the founder of Mathematizing Spirit and the developer of Axiometaphorical Thinking (AMT), an approach that investigates structural connections between mathematical reasoning and metaphorical ways of knowing. His work seeks to bridge scientific and spiritual ways of knowing while addressing the epistemological divisions that shape modern thought and education. His publications include “The Convergence of Modern Scientific and Traditional Earth Ways of Knowing, with Implications for Global Education” (2016) and the children’s book *What Is 1?* (2024). His research interests include epistemology, interdisciplinary inquiry, and the development of more coherent approaches to knowledge.