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Contemplative Mathematics Pedagogy: Report From A Pioneering Workshop

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ABSTRACT: Mathematics education researchers are beginning to appreciate the potential of contemplative–somatic practices such as mindfulness to alleviate student stress and increase their focus. Yet we still do not know whether, and if so how, these practices may support student learning of specific content. As a first step toward conceptualizing and ideating the pedagogical design and facilitation of content-oriented contemplative exercises, we convened an experimental workshop. Here we report on findings from this pioneering event that brought together scholars and practitioners interested in the relations between contemplative–somatic practice and mathematical reasoning and learning. We elaborate on participants’ experiences and derived pedagogical insights to offer the field new horizons in the development of the theory and practice of contemplative mathematics.

Objectives

Mathematics-education theorists have begun to explore the potential role of somatic–contemplative practices in mathematics pedagogy. These efforts include developing mathematics pedagogy (Brady, 2007), designing contemplative practice for students suffering from high math anxiety (Brunyé et al., 2013), examining the effect of “meditational mathematics” for special-needs students (Rodd, 2006), and investigating intentional structured reflection for mathematics researchers (Wolcott, 2013). Notably, all this important prior research has focused on the remedial benefits of contemplative practices, such as their ability to reduce stress and anxiety. However, as Morgan and Abrahamson (2016, p. 36) have proposed:

As long as contemplative practice is applied only to mathematics anxiety or business-as-usual number crunching rather than to deep embodied and pre-conceptual meaning making [of specific mathematical content], we submit, the field is only scratching the surface of contemplative practices and losing out on their very essence and gift.

Hence our quest, reported herein, is to go beyond remedial benefits of contemplative practice and gain insight into potential *targeted content* effects of these practices. We arrived at articulating these horizons by way of collaborating with experts from disciplines that have historically placed contemplative movement at the core of their scholarship and practice.

Perspectives

The idea of infusing mathematics education with contemplative–somatic practice (hence, CSP) occurred to us through engaging in design-based research on enactivist mathematics education. Enactivism holds that sensory perception is irreducibly intertwined with the action it guides and that cognitive structures emerge from recurrent patterns in perceptually guided action (Varela, Thompson, & Rosch 1991). Building on this foundational theoretical work, Hutto, Kirchhoff, and Abrahamson (2015) put forth an enactivist approach to conceptualizing mathematics learning, knowing, and reasoning. In this approach, knowledge—that is, the lived phenomenology of understanding, knowing, and reasoning—emerges through ecologically situated, goal-oriented multimodal sensorimotor activity. Yet just how cognitive structures emerge from sensorimotor activity to conscious reflection—what Piaget called reflecting abstraction (Abrahamson, Shayan, Bakker, & Van der Schaaf, 2016)—is not quite understood. In particular, Authur¹ and Abrahamson (2016) refer to an epistemic bottleneck between pre-symbolic notions and articulated expression. As it turns out, philosophers and psychologists have been concerned with this very issue of minding the gap between preconscious and conscious phenomenology (e.g., Morgan, 2017; Mason, 2003; Petitmengin, 2007; Roth, 2012; Stelter, 2000). We drew in particular on literature investigating mechanisms of CSP in opening epistemic bottlenecks between enactive and contemplative somatic modes of mathematical knowing.

Methods

The pioneering workshop we report on herein could be described as “experimental” in the sense of innovation, because we are not aware of any similar meeting in the past. That said, the workshop was not experimental or even quasi-experimental in the sense of scientific research design: There were no well-defined manipulation, measurement, or control as such. Still, we evaluate, this phenomenological experiment (Giorgi, 2012) grounded in first-person experience provides embryonic perspectives and insights worth sharing among the greater educational community.

On March 17, 2016, fifteen scholars gathered in a quiet hall in [Town-blinded], [State-blinded] to participate in a visioning retreat investigating potential relations between contemplative practices and mathematics education. The retreat was initiated and run by Patricia Morgan of New South Wales University, Australia, and Dor Abrahamson University of California, Berkeley and funded by Abrahamson’s group, the Embodied Design Research Laboratory. Morgan and Abrahamson sought to bring together contemplative somatic practitioners (Feldenkrais, Qigong, and Contemplative Art) and researchers from philosophy, cognitive science, and education interested in experiencing firsthand and sharing connections between physical movement, sensory perception, contemplation, reflection, and group dialogue.

The workshop was divided into three sessions framed by the contemplative practices and linked conceptually by the presenters’ shared concern with drawing participants into a somatic pre-conceptual space of learning, a ‘liminal’ space of learning’ residing between contemplative experience and cognitive assimilation of knowledge (Stelter, 2000). The entire workshop was audio–video recorded for subsequent qualitative analysis that generally followed principles of grounded theory (Glaser & Strauss, 1967; 1995; Strauss & Corbin, 1990) and interaction analysis (Jordan & Henderson, 1995) as applied to our entire body of data, including transcriptions of: participant discussions after each of the three practice sessions; the workshop’s concluding

conversation; and oral and textual dialogue among workshop facilitators before and after the workshop. Even as we searched for emerging themes in our data respecting participants' insights from the exercises as these relate to articulating pre-symbolic notions, we continuously interrogated implications of these themes for a heuristic design framework on CSP mathematics education.

Results

Analyses of the data corpus gave rise to several themes respecting workshop participants' experiences. Here we present these themes as contextualized in the workshop activities and the participants' contributions to the discussions. In discussing these themes, we draw implications for future design-research of CSP mathematics pedagogy.

Heightened Somatic Awareness. A central finding relates to the importance of heightened somatic awareness gained through contemplative practice. This experience surfaced new meanings for many of the participants, including emergent understandings of themselves as sentient–affective beings as well as attempts to conceptualize their workshop experiences in the context of developing a CSP mathematics. While participants commented most often on the expanded bodily awareness the exercises furnished, for some their limited prior personal experience with these practices apparently compromised their ability to access, remain in, and explain deeper embodied experience.

Insights from participants' reports highlighted exercises that most successfully supported their ability to gain expanded somatic awareness. One such exercise is *soft gazing* from Qigong, as it draws awareness in to the body by reversing the usual experience of sight as “looking outwards” (in the case of the workshop toward a vase of flowers) to one of “looking inwards” (where the flowers look at you). After experiencing soft gazing, one participant reflected that the challenge it posed to his usual experience of viewing an object had resulted in his awareness of a more nuanced understanding of vision. He said, “There is seeing, and there is seeing; there is hard looking-at, and there is soft receiving of images.” Results of this and similar exercises offer designers of math pedagogy insight into the embodied metacognition that may arise from participating in contemplative–somatic exercises. This increased awareness relates both to learning content and the self-awareness/realization of individual learning processes. Learning through the body in this way arises from engaging the subtleties of somatic awareness and is strengthened through practice, which hones new *felt meanings*. For example, a participant described finding muscular tension in his neck as he sought through his body for the new way of seeing in soft gazing. This is important, as in reaching for the part of himself that held the reversed vision, this participant stumbled across and released the tension in his neck that, he felt, had blocked his interoceptive path to sensing the flowers looking at him and thus sensing a new way of knowing (cf. Cole, 2004).

Describing the Preconceptual. A primary issue in CSP mathematics is understanding and describing, to one's self and others, one's fragile sensations and notions that are often characterized as ineffable. Thus when designing CSP mathematics, it is important to support students in “orienting differently” to their actions (i.e., shifting the mode of awareness toward nuanced multimodal sensations). In turn, it is important to scaffold students' deeper somatic awareness enabling this sensory reorientation. These experiences may be buttressed through the use of contemplative creative practices and specific forms of discourse. Importantly, these

reorientation techniques need to encompass the somatic, contemplative, preconceptual, conceptual, and idiosyncratic ways that students may engage such processes. These techniques center on the role of formulating language “inside-out,” that is, bridging the pre-conceptual–somatic into the semantic–semiotic realms of consciousness via contemplative creative practices. (Morgan & Abrahamson, 2016). After being asked to express a problem through contemplative art, a participant said:

The forms I drew were patterns; some rounded and spiraling... The problem, shown this way, included or seemed to represent itself in an organic context that did not comprise a negative... and it is easy to experience again in my memory.

Contemplative art provides entry to the somatic–pre-conceptual ground of learning and bridges the inner and outer realms: generating art brings forth pre-verbal meaning into words.

Making Meaning, Meaning-Making as Learning. A significant insight from our findings for designers of mathematics learning activities was the two-fold nature of meaning making arising from CSP. We found that participants’ meaning making was both *focused on* their somatic contemplative experiences and *facilitated by* this experience.

First, focusing on experiences led participants to realize particular sensations. One participant, reflecting on her Qigong experience, reported that through heightened awareness she could sense her actions shifting from discrete to continuous movements and that, in turn, this sensation brought about an improved performance of the entire form. Frequently, exercises offered access to increasingly refined abilities *to sense the process of change or learning as it occurred* in participants’ somatic interior. Thus tracing the steps in their learning enhanced participants’ ability to make cognitive meaning of their learning, which in turn supported the learning.

Second, participants attempted to make meaning conceptually either by reflecting on past experience or via conceptual models. For example, a participant, who through contemplative somatic experience conceived of a “cultural body,” linked this notion to ideas of generative faculties and sensory reality to form what he described as a “bodily algorithm,” which he understood to be a cultural form. This development of personal meaning-making narratives, as a significant aspect of CSP mathematics, needs to be encouraged through pedagogical devices. Both folds of meaning making, contemplative–somatic and cognitive, which occurred in the workshop, provide pedagogically rich approaches to assist in contemplative mathematics meaning making.

Educational Significance

A central tenant of CSP mathematics practice is that conceptual meanings come forth through planning, visualizing, and enacting movement. These three activities may be phenomenologically disparate yet they lead to similar outcomes by way of enhancing self-awareness of sensory pathways. As a participant said, “I’m just sort of struck by attention, the attention being held through the body so precisely, and then the second thing is attention about attention.” As discussed earlier, the theory of enactivism conceptualizes subjective cognition of mathematical concepts as grounded in reflective physical action on/with cultural forms, which may be material, virtual, or imaginary. Designers of mathematics learning activities build environments, activities, and facilitation protocols that create conditions enabling instructors to intervene in students’ skill learning processes by way of correcting their movement and/or

orienting their awareness to their proto-movement constitution that initiates movement (Abrahamson & Sánchez–García, 2016). When instructors apply these methods of heightening students’ somatic awareness, the instructors can also elicit “where” each student is in bringing forth a new notion. For example, students’ awareness of pre-action can indicate for the instructor’s ongoing formative assessment whether the students are, or have been, in the pre-cognitive ground of learning.

Focusing on different forms of instruction, media, and representational systems is important when designing CSP mathematics. Media and representational systems can be used to document and communicate target sets of actions, such as in visualizing for students feedback on their movements. In turn, media can furnish designers with crucial information, such as signifying the ways students have read and understood traces of their own movement interaction. Multimodal expressive activity, in particular verbal and gestural utterance, create for instructors a linguistic manifold for guiding students in nuanced, indirect manner. The workshop evidenced occasions of Feldenkrais Method and Qigong facilitation methods carrying students beyond the immediate context to consider and enact movement forms, particularly via Qigong’s cultural–historical use of somatic metaphor and Feldenkrais Method’s use of instructions for imagined movement.

Finally, two common outcomes of the workshop’s CSP with implications for mathematics design are that students develop: enhanced ability to focus; and precise awareness of cognitive resources, which in turn supports heightened focus. Greater awareness of cognitive resources also enhances the ability to assemble these resources for problem solving. Resonating auspiciously with the AERA 2019 conference theme, educational research on CSP could legitimize students’ “multimodal narratives” of emerging mathematical concepts.

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