

# Democratizing Engineering Education Through Contemplative and Mindfulness Practices

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**Abstract**— In this pre-conference workshop, we present the ways in which contemplative and mindfulness practices can serve to democratize engineering education. Contemplative practices allow individuals to gain a deeper understanding of themselves, others and their context by integrating the body – both, its physical and affective expressions – and mind. Despite the benefits of these practices for creating learning environments that are authentic, purposeful, holistic, and inclusive, these pedagogies are underutilized in engineering curricula. In this workshop, we will provide an immersive introduction to contemplative practices to co-create a sense of what engineering education environments can look like when they employ mindful, affective, and embodied ways of knowing. Participants will leave with a toolkit of contemplative practices, including sensory and visual meditation, deep listening, beholding, contemplative movement, and critical reflection, which will equip them to reimagine the ways in which they promote students’ capacity for self-awareness and reflection in their own learning contexts. Rooted in the practices of mindfulness, these strategies allow the co-creation of environments that are more conducive to learning and inclusive of all ways of knowing and being, thereby democratizing engineering education.

**Keywords**— *contemplative practices, mindfulness, meditation, self-awareness, critical reflection, embodiment, inclusion, democratic education*

## I. INTRODUCTION

Educational practitioners and institutions strive to educate the whole person while also developing students’ capacities to problem solve, think analytically, and understand complex disciplinary content. Ideally, students from diverse backgrounds can engage in their learning experiences in ways where they all are able to recognize the relevance of the material that they are learning and apply it to their own lives. However, it remains challenging to “present material in a way that supports students having their own agency so that the material is not simply a set of intellectual hoops to jump through but an active opportunity for them to find meaning and develop intellectually” [1]. Rising to these challenges is especially relevant at a time when higher education is under critique for failing to equip its students with the vision and disposition for using what they have learned to contribute to the society at large [2,3]. As Arthur Zajonc, physicist and the first academic director of the Center for Contemplative Mind, posited, “The university is well-practiced at educating the mind for critical reasoning, critical writing and critical speaking as well as for

scientific and quantitative analysis. But is this sufficient? In a world beset with conflicts, internal as well as external, isn’t it of equal if not greater importance to balance the sharpening of our intellects with the systematic cultivation of our hearts?” [4]

Based on the concepts of mindfulness, contemplative practices respond to these challenges by providing an introspective and internal focus that creates opportunities for greater connection, awareness, and insight. While the practices include meditation, they are not limited to conventional conceptions of meditative practices. In fact, participants engaging in these practices may be silent or speaking, still or moving, observing or engaging in analytical thought [1]. This diversity of form allows for contemplative practices to support a wide range of values, goals, and objectives, including but not limited to activist work (e.g., vigils, marches, volunteering), relational activities (e.g., council circle, dialogic practice, storytelling), creative undertakings (e.g., journaling, improvisation, singing), rituals (e.g., ceremonies based on cultural traditions, retreats), and generative processes (e.g., visualization, beholding, contemplative reading) [5]. As such, contemplative practices are amenable for use in any discipline while being united by an intention “to integrate students’ own rich experiences into their learning” [6]. By allowing students to frame the disciplinary content knowledge through a personal context, contemplative practices ultimately allow them to gain agency over their learning processes and improve learning outcomes related to understanding and retention of material [1,6]. Additionally, the process of honoring personal ways of knowing and being during collective inquiry with classmates generates an environment that is inclusive, builds capacity to connect knowledge to practice and self to context, generates compassion, and initiates inquiry into one’s human nature [1].

Particularly relevant to this workshop, contemplative practices allow for the co-creation of an educational paradigm that extends the Belenke *et al.* framework of “silence, received knowledge, subjective knowledge, procedural knowledge, and constructed knowledge” to include embodied and other ways of knowing [7]. Using this framework of more inclusive ways of knowing, educators can create learning opportunities for all students, particularly those underprivileged by current Western, male-centric pedagogical practices that divorce body from mind and experience from knowledge [8,9]. By removing these dualisms through and within the learning experience, it is possible to “render [knowledge] more accessible to [everyone

and particularly to] women and underprivileged communities, [and] also help cultivate citizenry for action and change” [10].

Current literature demonstrates that contemplative practices are effective and beneficial for all types of students and promote more inclusive educational environments [1,11]. And yet, these practices are only now emerging in Science, Technology, Engineering and Mathematics (STEM) curricula. After an extensive search for literature documenting the use of contemplative practices in engineering that goes beyond reflective practice popularized by Donald Schön [12], we found little evidence of their use in engineering classrooms.

Recently, we contributed to the nascent field of contemplative practices in engineering education by creating a new physics foundation course for engineers that utilized contemplative pedagogies to develop learners’ capacity for deeper self-awareness and reflection. Our preliminary findings demonstrate that this learning environment provided students with a scaffolded opportunity for self-discovery, personal growth, and re-examining science/engineering through their diverse ways of being and knowing. Students found this type of experience to be personally significant and valuable, but otherwise absent in their engineering education [13]. The paucity of contemplative practices in engineering education in conjunction with their demonstrated benefits reveal a new, underutilized opportunity to foster students’ personal and professional development, connection to their context, values, and beliefs while also improving learning outcomes more traditionally described in engineering courses.

In this workshop, we will provide participants with the tools to consider how they can use contemplative practices to co-create inclusive learning environments that allow students to build community, develop awareness of and through their bodies and senses, and learn about themselves and others. The workshop will utilize several hands-on and embodied activities to give participants an experiential understanding of the cognitive and emotional environments that can be created to enhance the learning of all students by including all ways of knowing and being. The workshop agenda is divided into four parts: Part 1 uses contemplative practices to ground participants in the moment and allow participants to get to know each other; Part 2 provides foundational knowledge on contemplative and mindfulness pedagogies; Part 3 consists of a series of hands-on and embodied activities to give participants an experiential understanding of a variety of contemplative practices that can be used in engineering education; Part 4 provides contemplative closure by allowing participants to reflect on how they can bring their experiences back to their own learning contexts.

## II. WORKSHOP GOALS

This workshop provides engineering educators with tools to create learning environments that develop students’ capacity for deeper self-awareness and reflection through contemplative practices. Specifically, this workshop will demonstrate through hands-on and embodied activities how the use of contemplative pedagogies in a classroom environment may allow students to engage in (1) consideration of interdisciplinary perspectives that transcend disciplinary boundaries; (2) the process of being aware about the ways in which engineering applies to collective and individual human experience; (3) sense-making process

about human experiences as embodied beings in the physical universe [14]; (4) reflecting on themselves as learners with unique ways of knowing; (5) developing skills for open-ended learning environments, including curiosity, empathy, communication, and teamwork.

By sharing the ways in which some of the contemplative pedagogies may be used in STEM curricula, we hope to shine light on yet another pathway for democratizing engineering learning environments through inclusive ways of teaching, learning, knowing, and being.

## III. WORKSHOP DESCRIPTION

In this workshop, we will introduce a number of contemplative practices, including examples of sensory meditation and visualization, deep listening, beholding, contemplative movement, and critical reflection. These practices will then be leveraged to co-create a sense of what an engineering classroom might look and feel like when mindful, affective, and embodied ways of knowing are engaged in creating an environment that shifts learners’ perception of what is known, how it is known, by whom, and with what tools. We will then specifically focus on one practice, contemplative movement – engagement in group activities using ourselves and our bodies – to first develop a circle of trust with our participants as a way of demonstrating how such an environment may be created in a classroom. Through a series of movement activities, we will then begin to create a sense of community, to see who we are and learn about others, to develop awareness through and of our bodies and senses, to help us be in touch with who we are. At the core of what we are proposing to do lies the practice of mindfulness. Although explicitly holding the root word “mind,” mindfulness practice, in a kind of aikido move, that takes away the power of Western mind/body dualism and gives way to integration of mind and body for the purpose of gaining awareness of oneself (e.g., one’s ongoing cognitive and emotional processes) and Another (e.g., ongoing processes in the physical universe) [14].

### A. Detailed Agenda

1) *Introductions and co-creating the learning environment (30 min)*: We will begin the workshop with a brief arrival meditation to help center participants and bring their awareness into the present moment. The facilitators and participants will then get to know each other using a contemplative practice based on each of our names. This opening will co-create a safe and inclusive space with and for all participants to allow for a learning environment of experimentation and curiosity.

2) *Contemplative and mindfulness practices and pedagogies (30 min)*: The facilitators will establish theoretical and practical background for contemplative and mindfulness practices as they are used in educational environments, with an emphasis on the the core unifying intent of contemplative pedagogies to cultivate learners’ awareness and insights [1]. Facilitators will introduce the various forms that contemplative practices can take, including activist practices, creative practices, generative practices, movement practices, relational practices, ritual/cyclical practices, and stillness practices [5].

Participants will be encouraged to identify practices from their own experiences that can serve contemplative functions.

3) *Hands-on and embodied activities (90 min)*: Participants will be guided through a series of contemplative activities including deep listening, beholding, and critical reflection. The facilitators will then leverage examples of how contemplative movement pedagogy can be used in the context of a foundational physics course. Specifically, participants will explore synchrony, leading, and following through movement to gain an embodied perspective of the concepts of momentum, force, stillness, motion, and the interplay between system and surroundings. These activities will provide an experiential understanding of how contemplative practices can allow individuals to build community, increase awareness of and through their bodies and senses, and deepen understanding of themselves and others, while also engaging in embodied learning of scientific content.

4) *Conclusion (30 min)*: The workshop will end with a contemplative reflection on participant experiences in the session and how they can bring these experiences back to their own learning contexts. This time will also provide an opportunity for interested participants to engage in creating a network to support future work in embedding contemplative pedagogies in engineering learning contexts. The session will end with a departure meditation to help participants bring their awareness back to the current moment and prepare them to continue the process of engaging with the knowledge, skills, and experiences shared in the session.

### B. *Intended Audience*

This workshop is intended for a diverse set of attendees, including faculty, students, and staff across all fields of engineering education. We expect that the session will provide relevant and valuable tools to all participants, regardless of their roles in the educational system. We hope that participants will leverage the activities used in the workshop both personally and professionally to practice mindfulness, increase self-awareness, authentically connect with others, and co-create spaces for holistic and inclusive learning. Given the nature of this workshop, the maximum number of people we can accommodate is 30.

### C. *Take-away Skills, Knowledge, and Tools*

The attendees will acquire a basic toolkit to begin thinking about the ways in which they can co-create a space of mindfulness in their learning environments. Through several hands-on and embodied activities used in the workshop, participants will gain an embodied sense of a cognitive and emotional environment more conducive to their students' learning and, more importantly, an environment that is inclusive of all ways of knowing and being, thereby democratizing the educational experience they provide for their learners. We hope that the sense of community built during the workshop will serve as the foundation for a supportive network of individuals interested in embedding contemplative practices in engineering education.

### D. *Special Requirements*

Participants should come prepared to actively participate in this online workshop through movement (embodiment), conversation, and co-creation of values aligned with contemplative practice within the engineering education paradigm.

## IV. QUALIFICATIONS OF WORKSHOP PRESENTERS

Madhvi J. Venkatesh is a dancer, choreographer, researcher, and educator who co-founded Prakriti Dance and serves as a Lecturer and Associate Director of Graduate Education at Harvard Medical School. As an educator, she explores how movement and dance can convey various curricular concepts from social sciences, mathematics, and science. Her latest project, "Through Fish Eyes," uses the movement vocabulary of the classical Indian dance form Bharata Natyam to raise awareness about dwindling marine ecosystems. In her scholarly work, she is beginning to explore how information/data from various disciplines is represented through artistic movement and what analysis of movement tells us about the people who created it.

Yevgeniya V. Zastavker has been practicing mindfulness and contemplative ways of being since late 90's and has been moving her educational practice and scholarship into a space of contemplative pedagogies and mindfulness for the past several years. Her autoethnographic work led her to gain voice and redefine her identity as a refugee in the current political climate, a woman in a historically masculinized world of science and engineering, a qualitative scholar in a domain where quantitative scholarship is being privileged, a scientist in a school of engineering, and a spiritual worker and a dancer in a world where mind-body-spirit connections are explicitly and intentionally severed.

The presenters have co-created a new course offering for engineering students in which contemplative practices are embedded throughout. They are currently engaged in a research endeavor to understand the rich ways in which this course affected students' holistic development. It is this practical and research experience with contemplative practices in an engineering context that the presenters will share with the workshop participants.

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## REFERENCES

- [1] D. P. Barbezat and Bush, Mirabai, *Contemplative Practices in Higher Education*. San Francisco, CA: Jossey-Bass, 2014.
- [2] M. C. Taylor, *Crisis on Campus: A Bold Plan for Reforming our Colleges and Universities*. New York, NY: Alfred A. Knopf, 2010.
- [3] H. Lewis, *Excellence without a Soul: Does Liberal Education Have a Future?* New York, NY: PublicAffairs, 2007.

- [4] A. Zajonc, *Love and Knowledge: Recovering the Heart of Learning Through Contemplation*, delivered at the "Contemplative Practices in Education: Making Peace in Ourselves and Peace in the World" conference at Columbia University, February 13, 2005.
- [5] M. Duerr and C. Bergman, "The tree of contemplative practices," The Center for the Contemplative Mind in Society. [www.contemplativemind.org/practices/tree](http://www.contemplativemind.org/practices/tree) [accessed April 18, 2020].
- [6] D. Barbezat and A. Pingree, "Contemplative pedagogy: The special role of teaching and learning centers," in *To Improve the Academy*, vol. 31, J. E. Groccia and L. Cruz, Eds. San Francisco, CA: Jossey-Bass, 2012.
- [7] M. F. Belenky, B. Clinchy, N. R. Goldberger, and J. M. Tarule, *Women's ways of knowing: The development of self, voice, and mind*. New York, NY: Basic Books, 1986.
- [8] K. N. Barbour, *Embodied ways of knowing. Women's solo contemporary dance in Aotearoa, New Zealand*. Unpublished doctoral thesis, 2002. The University of Waikato, Hamilton, New Zealand.
- [9] K. N. Barbour, "Embodied ways of knowing," *Waikato Journal of Education*, vol. 10, pp. 227-238, 2004.
- [10] H. N. Wilcox, "Embodied ways of knowing, pedagogies, and social justice: Inclusive science and beyond," *NWSA Journal*, vol. 21, no. 2, pp. 104-120, 2009.
- [11] A. Zajonc. "What is contemplative pedagogy?" In *Contemplative Practices in Higher Education: A Handbook of Classroom Practices (Draft)*, 9. Northampton, MA: The Center for Contemplative Mind in Society, 2008.
- [12] D. A. Schön, *Educating the Reflective Practitioner: Toward a New Design for Teaching and Learning in the Professions*. San Francisco, CA: Jossey-Bass, 1987.
- [13] M. J. Venkatesh, D. Freeman, A. Fry, A. Hindelang, J. Bermejo, E. Berke, and Y. V. Zastavker, "Contemplative practices as a way of creating inclusive environments in engineering education: A story of one physics foundation experience for engineers." *Proceedings of the 2020 ASEE Conference & Exposition, Montréal, Canada*, in press.
- [14] Z. Krusberg and M. Ward, "Classical physics and human embodiment: The role of contemplative practice in integrating formal theory and personal experience in the undergraduate physics curriculum," *The Journal of Contemplative Inquiry*, vol. 5, no. 1. pp. 87-106, 2018.