

The Future of Embodied Design for Mathematical Imagination and Cognition

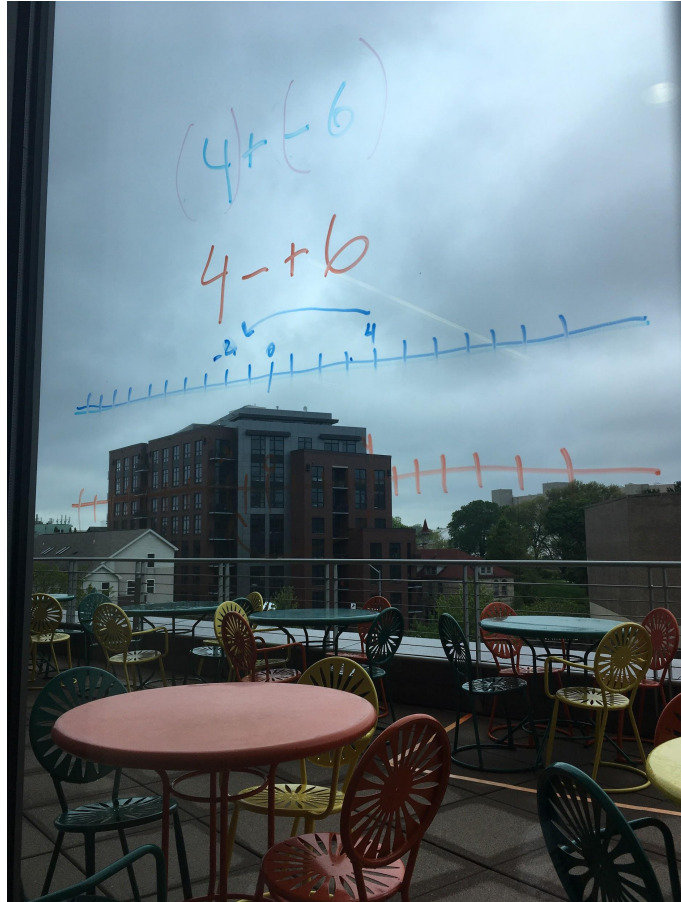
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Driving Questions / Purpose



The goal is to form a ten-year research agenda that will provide a coherent set of evidence-based design principles for enhancing mathematics education and broadening participation in all STEM fields.

This driving purpose is particularly crucial due to the newness and interdisciplinary nature of the EMIC field. Represented at the workshop were EMIC experts from the fields of: learning sciences, psychology, dance and movement science, linguistics, computer science, education and special education, and mathematics.

Participants

Teachers (K-20) - Educator Roundtables (5)

Students, Postdocs, Early Career - Poster Session (19)

Faculty - Presentations (21)

Primarily from the United States - but 6 international participants

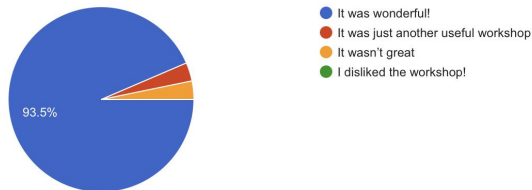


Keynote Speakers and Discussants from outside the field, to push our thinking:

- Keynote - Dr. Brian Bottge (Mathematics and Special Education)
- Keynote - Dr. Maxine McKinney de Royston (Mathematics and Multicultural Education)
- Discussant - Dr. Art Glenberg (Language and Embodied Cognition)
- Discussant - Dr. Jim Slotta (Technology and Learning)

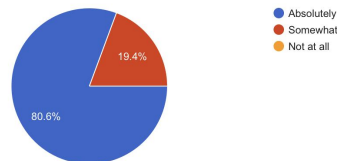
Did you enjoy your time at the EMIC workshop?

31 responses



Do you think that your future scholarly or professional work has been in any way influenced by this workshop? Such as through learning, presenting, teaching enacting, or developing new collaborations.

31 responses



I particularly liked: - the choice of keynotes (providing fresh perspectives on embodied learning) - the opportunities for colleagues at a range of career points to contribute - the inclusion of teachers

Process

- Everyone who attended led something: a presentation, a poster, an educator roundtable, and/or an embodied activity
- Activities designed to support mathematical learning through embodiment *grounded* the experience
- Organizing committee screened formal applications, reached out to invited presenters. Almost all accepted participants fully funded to attend

Because everyone participated in some form, the workshop had a greater sense of collaboration and investment than other experiences I've had.

Size and mix of talks, activities, breaks was perfect - I feel I got to meaningfully interact with almost everyone there.

As a teacher, I found this invaluable. I have been pushed to think of education in a whole new light. ... I have made connections with impressive people who look to enhance the face of learning. I am in awe of the work they do. What was so humbling about this week was the fact that these incredible people wanted to hear my voice. They wanted to listen to the challenges I face and celebrate the growth I experience. I cannot thank these organizers and participants enough for helping me emerge as a stronger, more well-rounded educator.

Findings

Research: lively discussions that reflected the many diverse and complementary methodological considerations of this emerging inter-discipline.

Theory: leverage interdisciplinary connections into a coherent collective voice that identifies consistent learning principles that inform Embodied Design for Mathematical Imagination and Cognition (EMIC), while preserving the distinct disciplinary identities.

Practice: consider how EMIC perspective broadens STEM participation for those minoritized and differently abled; increase awareness for gesture as signifying content-related communication; consider the classroom environment, curricular objects, and teacher needs when introducing technology; enable movement; begin from intuition.

Theory-Practice Relations: there was a distinct sense of urgency for participatory design, and an emphasis on the need to keep including teachers when we are designing experiences for the classroom. Particular need for evidence that gesture facilitates learning and instruction.

Reflection, Planning, and Resources: we need to strategize for community development, intellectual cohesion, identity, longevity, and impact.

Principles

71% (n = 22) definitely agree with: *More experimental evidence is needed to pinpoint the specific interactions between students, subject matter, and situated, grounded and embodied curricular design.*

67.7% (n = 21) definitely agree with: *I operate under the assumption that all cognition is inherently embodied.*

61.3% (n = 19) definitely agree with: *I am still learning about cognition, and how we learn.*

[I use principles from the field of] Gesture Theory - 75%

I consider social emotion to be something that can impact conceptual integration - 62.5%

[I use principles from fields that focus on designing] dynamic gesture-based interfaces for mathematics - 56.25%

[I consider that] dynamic gestures allow participants to physically experience generalized properties through enactment - 56.25%

[Learners should] “experience first, signify later” - 56.25%

We should encourage physical and spatial exploration of the structure of algebra - 50%

[I use principles from the field of] Distributed Cognition - 50%

*I primarily or
sometimes use
frameworks by:*
Alibali
Nathan
Lakoff & Nunez
Abrahamson

Surprises & Tensions

There are unanswered questions regarding different types of embodiment that need investigation - 84.38%

Teachers are professionals that should be deeply involved in developing, adopting, and adapting embodied learning activities - 81.25%

There are unanswered questions regarding working with practitioners that need investigation - 75%

Teachers should be able to adopt and adapt body-based learning activities - 75%

Activities should be designed to leverage our naturally occurring perceptions towards conceptual understanding - 71.88%

What counts as math (and who decides) is a constant tension in this interdisciplinary field - 62.5%

There are unanswered questions regarding research practices that need investigation - 59.38%

*Dance and Math!
Frickin-Ay!
Who knew?!*



Recommendations

Immediate Applicability:

- Talk about EMIC research with everyone you know
- *We have immediate plans to redesign www.embodiedmathematics.com*

Near-Term:

- Cultivate K-20 teacher-researcher-policymaker partnerships
- Promote opportunities to share and curate empirical inquiry into the conditions for designing EMIC for instruction, assessment and learning environments
- Investigate how EMIC addresses equity in our classrooms

Longer Term:

- Consolidate and integrate so that we have a stable, shared theory
- Promote a long term commitment for funding research on embodied cognition, instruction, and assessment practices

Requests to continue holding regular EMIC workshops were included in all three categories by different survey respondents.

*Be theoretically rigorous,
be proud,
be brave,
stick with EMIC.*