Using Multiple Embodied Representations to Support Learners in Making Connections Across Modeling Activities

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Abstract: My research aims to help students see familiar cultural practices, such as dance, as a resource in understanding scientific concepts and building bridges from their everyday lives to disciplinary norms. I build on the previously successful Science Through Technology Enhanced Play (STEP) mixed-reality learning environment that combines motion-tracking technology with a computational simulation and provide learners the opportunity to use dance, a fun and familiar practice for all participants, to share their understanding from STEP and why it matters to them.

Vision

Embodied theories of learning highlight the processes in which expressive gesture and body movement act as key representational resources (Abrahamson & Sánchez-García, 2016). The role of the body in learning is well-studied in laboratories and formal environments, but the potential for using familiar embodied activity to help bridge between out of school practices and scientific ones is understudied and under-utilized. The goals of my dissertation are to: (1) support science learning across contexts by connecting multiple representations that leverage the body; (2) expand participation in science by studying how embodied representations can support the engagement of students from diverse backgrounds in science activities across learning contexts, and; (3) explore how dance, a familiar and popular form of embodied activity, might connect their informal experiences with science.

My dissertation builds on evidence that early elementary students can construct explanatory and predictive models. While existing literature suggests young children are capable of sophisticated modeling practices, focus is predominately on modeling by *individuals* and models as *visual* representations. By contrast, my dissertation will address this gap by investigating two forms of models that are instead *collective* and *embodied*: participatory models (Danish, 2014) and ensemble dance. Collective embodied models are powerful tools for cooperative and coordinated reasoning as they ask learners to move and think relative to each other. For example, in a participatory model learners physically enact parts of a complex system and in doing so learn its mechanisms and rules. Similarly, in an ensemble dance individuals move together in locally valued and mutually understandable ways to co-create shared meaning.

Students, ages 6-8, participating in a performing arts summer program will progress through a five-week sequence of modeling activities to explore the relationship between macroscopic states of matter and microscopic particle behaviors. Each activity is divided into two parts. In the first part, students will engage in embodied scientific modeling, which targets exploring and learning science concepts. Then, during the second part, students will be asked to choreograph and perform a dance to represent what they learned and why it matters to them. Thus, students will be building on local dance practices and personal connections to make sense of the science, affording an opportunity to engage in science in a way that is both fun and familiar. The participatory modeling activities build on the previously successful Science Through Technology Enhanced Play (STEP) mixed-reality learning environment that combines motion-tracking technology with a computational simulation (Danish et al., 2015). Dance-based activities will be co-designed with local performing arts instructors and focused on the genres and techniques of dance the students are already interested in and engaging with.

Analysis will focus specifically on how interactional mechanisms (e.g., talk and embodied action) are assembled to evaluate the rules of science, representational infrastructures, and social participation. Through this in-depth analysis of the video data, I aim to locate the representational resources that support learners' movement from disciplinary to dance-based embodied representations (and back again), and what is learned during this process. Given the importance of connecting science with students' everyday lives, my dissertation will advance designing for learning across disciplines and settings by leveraging the body as a primary representational pathway.

References

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