Abstract

Objective: To investigate how the integration of vestibular-activating sensory tools into math instructional designs impacts a learner who is frequently vestibular-seeking.

Methodology: This is a pilot for a broader mixed methods design-based research project using the Balance Number Line (BNL), a balance board-based math design that incorporates a common sensory regulatory movement, rocking, into conceptual learning about absolute value and negative numbers. A semi-structured pedagogical interview was conducted consisting of a series of mathematical tasks on the BNL with a 13-year-old learner on the autism spectrum who self-reported frequent vestibular seeking behaviors (jumping and climbing). Qualitative data analysis was conducted on audio-video recording of sensory behavior type and function over the course of the interview.

Results: While completing mathematical tasks with the BNL, the participant fluidly engaged in vestibular sensory behavior in several ways: 1) leveraging mathematical artifacts to act upon, including rocking between positions on the number line to rock the same degree to each side; 2) using rocking as feedback about mathematical quantities, as when comparing the degree of tilt associated with two positions on the number line; 3) self-regulating, engaging in rhythmic rocking between problem-solving episodes.

Discussion: This case shows that the sensory design of instructional materials shapes what sensory input may become a resource for conceptual learning. This suggests the importance of evaluating the forms of sensory engagement offered by dominant learning tools such as lectures and manipulatives.

Conclusion: In the sensory-enriched context of the BNL, sensory behaviors such as rocking entered into mathematical discourse and in parallel, supported spontaneous sensory regulation. New forms of multisensory (here, vestibular) learning engagement are possible that may be better suited to some learners’ sensory profiles.

Background

• Cognitive science suggests that conceptual learning is rooted in sensorimotor experience (Varela et al., 1991). This suggests that the sensory composition of learning tasks stands to impact students’ access to conceptual learning (Tancredi et al., 2020).
• Supporting learners’ sensory needs (Dunn, 1997) is often approached by providing supports in parallel to or outside of academic activities. This project investigates how integration of enhanced sensory activation into the learning design itself affects learning and engagement.
• Design perspective: The integration of vestibular-activating sensory tools with learning designs will improve their efficacy for learners with vestibular sensory-seeking tendencies.

Research Questions

1. How does sensory engagement and behavior partake in mathematical thought?
2. How do sensory task demands interact with learner-initiated sensory-regulatory behaviors during learning?

References