

Overview

The Urban Griot Collaborative (UGC), the PI's research lab in the College of Arts, Media, and Design at There is a growing need within the field of STEM education for practitioners to equip "children with opportunities to see, touch, and feel the learning in practice, within multiple embodiment ways" [1]. This "theoretical approach is rooted within a social semiotic perspective that has indicated that multimodality enables children to use different types of expression to communicate a message or share an idea." [2]. Recently, attention has been given to increasing integration of cultural practices into STEM education, to enhance learning outcomes and student engagement [3] [4] [5]. While rhythm-based and movement-linked pedagogical activities and games have been known to play a supportive role in children's early learning experiences – for example, with the use of clapping, music or body movement for developing the phonemic awareness and aural intelligence needed for literacy development [6] – few educational approaches embrace cultural practices as a starting point for the design of culturally-grounded embodied learning environments. A growing body of research recognizes drumming as a medium for personal growth, development, community engagement, and physiological and psychological healing [7]. However, existing approaches to integrate drumming in schools, founded largely upon behavioral theories of change, place little emphasis on literacy development, nor consider shifts within cognitive science and music cognition focused on an embodied approach [8]. This proposal aims to launch the next phase of my career in designing and evaluating a culturally grounded and literacy-theory informed embodied learning environment design framework that integrates a deeper engagement with cultural practices through the ECE activity system and informs how we can investigate children's multimodal meaning production and literacy development through *digital drum talk*.

Keywords: Early Childhood Education, Embodied Learning Environments, Co-Design, Digital Musical Interfaces, Parent-Child Technology Interactions

Intellectual Merit

This project introduces a novel interdisciplinary approach to early childhood STEM education by integrating embodied learning, music cognition, and cultural media design into a unified, data-informed framework. Through the development of rhythm-encoded educational tools and interfaces rooted in the drum language system, the research advances knowledge at the intersection of HCI, early literacy, digital music instruments (DMIs), and African diasporic knowledge systems. Using a design-based research (DBR) methodology and learning analytics, GriotQuest investigates how culturally grounded rhythmic communication can support young children's multimodal literacy and STEM concept development. The work extends culturally relevant pedagogy (CRP) to encompass full-body interaction and non-Western communication systems, positioning drumming not only as a musical but as a linguistic and educational act. The project also pioneers a new class of "Digital Orality Systems," expanding the communicative and analytical potential of rhythm in education technology. Overall, this research will generate new theory, frameworks, and empirical findings at the intersection of music technology, HCI, early childhood education, and learning sciences, with wide-ranging implications for how multimodal literacies are supported in informal and formal settings.

Broader Impacts

GriotQuest will generate replicable, culturally responsive models for informal STEM learning through community-engaged co-design. By centering the cultural funds of knowledge of Black families and early educators, the project aims to increase equity and representation in STEM education and professions. It will foster long-term collaborations between academic researchers, community organizations, families, and policymakers, while also training undergraduate and graduate students in culturally responsive technology design and participatory research methods. The system's home-accessible technology and media will broaden its reach across African diasporic communities, and the rhythmic, embodied learning paradigm holds promise for learners with diverse needs, including children with communication challenges. This work will contribute to national efforts to reimagine early childhood education through inclusive, justice-oriented innovation and has the potential to inform education policy, teacher training, and the design of equitable learning technologies for generations to come.