

# Panel: Partnerships built for equity: Neurodivergent learners and the use of CT

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**Abstract**— We propose that CT is a fundamental and transversal skill which could be taught more effectively using embodied modes of instruction. In this panel we will discuss how various uses of Telematic Embodied Learning (TEL) enables neurodivergent, specifically autistic, middle school students to learn computational thinking from different perspectives. We discuss how we embed mastery of CT and select computer science concepts in creative ensemble activity, using tangible digital-physical musical technologies and techniques accessible to a wider range of neurodiverse students. Researchers, community partners, and teacher fellows will illustrate how the iterative co-design process and practitioner model provide data on the kinds of support and training teachers would need to design learning interactions where neurodiverse students develop computer science concepts. More specifically, our mixed methods research utilizes quantitative research to foreground scalable and generalizable neurodivergent practices and CT pedagogies and qualitative research to highlight students, teachers, parents, and future employers' perceptions and experiences of neurodiversity and neurodiverse pedagogies. We share our current developments of TEL Labs for students, parents, and employers, and how we prepare workshops for teachers from collaborative schools to guide them in socially engaging learning labs.

**Keywords**—telematic embodied learning, neurodiversity, computational thinking

## I. INTRODUCTION

Online learning, also in the context of computational thinking (CT), tends to reproduce education and learning modes that privilege linear, isolated, neurotypical, and cognitivist thinking over that of creative, interdependent, and embodied interaction. Students with disabilities, specifically autistic students, too often find themselves without the support needed to excel academically, socially, creatively. Leaders, teachers, parents, and autism advocates from Science Preparatory Academy and the Neurodiversity Educational Research Center (NERC), together with faculty, doctoral students, and education

researchers in Synthesis, the School of Arts, Media and Engineering, and Mary Lou Fulton Teachers College at ASU have collectively conceived the questions, practical problems, and conceptual framework for this project.

Despite its promise, discrepancies in the implementation and access of CT persist. For example, the foundations of CS and CT are often inaccessible to individuals with disabilities [1,2]. Co-developing fresh techniques and technologies sensitive to diversely embodied experience together with learning methods appealing to innate playfulness such as music-making can help build CT skills while building social and emotional capacity. This study uses Telematic Embodied Learning (TEL) enabling neurodiverse autistic middle school students to learn computational thinking via manipulatives [3]. We embed mastery of CT and select computer science concepts in creative ensemble activity, using tangible digital-physical musical technologies and techniques adaptable to a neurodiverse range of students [4,5,6,7]. Our emphasis on embodiment is motivated by substantial work from sensorimotor research showing that the quality of perceptual experiences is intertwined with the perceiver's dynamic, corporeal engagement with the physical environment [8]. This project is motivated to improve and transform education through engagement with research.

## II. PANEL STRUCTURE

This panel will begin with 10-minute presentations from the panelists about their experiences of the collaboration, TEL, CT, and facilitation of embodied computational thinking among students. Each panelist will introduce a different aspect of our collective experience (CT/technological considerations, school partner perspectives, pedagogical and methodological considerations). Following the presentations, the moderator will ask questions of the panelists and then open the discussion to the audience. This panel will be moderated by Timothy Wells.

Questions that may be asked during the initial discussion include the following:

- How does one build partnerships for equity?
- How does embodiment and wearable technology enhance learning CT?
- How are learning materials and teaching approaches for neurodiverse students developed?
- What practical considerations guide collaborative projects focusing on neurodiversity?

### III. POSITION STATEMENTS

Timothy Wells serves as a moderator and five panelists are Denise Amiot, Seth Thorn, Mirka Koro, Anani Vasquez, and Sha Xin Wei.

#### A. Timothy C. Wells (*he, his*)

Timothy C. Wells (PhD, Arizona State University) is a Postdoctoral Research Scholar in the Teachers College at ASU. His work resides in the field of curriculum studies, qualitative methodology, and the learning sciences, exploring how histories, cultures, and philosophies shape the experience of knowledge, embodiment, and disability. His dissertation explored the modernization of student misbehavior and teacher pedagogy in nineteenth century teacher manuals. He has published in Teachers College Press, *Qualitative Inquiry*, and *Discourse: A Journal of Culture and Education*.

#### B. Denis Amiot (*she, her*)

Ms. Amiot (M.Ed, University of Cincinnati) is the Director of Science Prep Academy in Phoenix, Arizona. Her educational career spans over 35 years teaching exceptional students, kindergarten through post high school age. She has also taught at the university level for twelve years, working with students who desire a career in teaching. Denise was born in Ohio and was the first in her family to earn graduate degrees from universities. She received her teaching degree from Edgecliff College and an Administration degree from Xavier University. She has been a Doctoral student at Walden University in the field of Leadership and Curriculum.

#### C. Seth D. Thorn (*he, him*)

Dr. Thorn (Ph.D., Brown University) is Clinical Assistant Professor of Media Computing at the School of Arts, Media + Engineering at ASU. An accomplished violinist and musician, he brings the familiar experience of the blurring of corporeal boundaries in embodied performance, augmented with adapted real-time computational media, into dialogue with philosophical studies on materialism, affect, and relation, bridging these studies into social impact increasing inclusion in computing. He has published at numerous specialized ACM conferences (*TEI*, *MOCO*, *C&C*), *NIME*, and in *Organised Sound* (Cambridge UP), *Wearable Technologies* (Cambridge UP), *Leonardo Music Journal* (MIT Press), and *Qui Parle* (UC Berkeley).

#### D. Mirka Koro (*she, her*)

Dr. Mirka Koro (Ph.D., University of Helsinki) is a professor of qualitative research and director of doctoral programs at the Mary Lou Fulton Teachers College, Arizona State University. Her scholarship operates in the intersection of qualitative inquiry, methodologies, philosophy, and socio-cultural critique.

Theoretically she draws from critical and post-theories. She has published in various qualitative, methodological, and educational journals. Mirka was born in Finland to a working-class family. She is able-bodied native Finnish speaker who later immigrated to the US. She is also a former elementary school teacher, and she received her teaching degree from the university of Tampere, Finland.

#### E. Anani Vasquez (*she, her, ella*)

Mrs. Anani Vasquez is a doctoral candidate in the Learning, Literacies and Technologies Program at the Teachers College, ASU. She holds a master's degree in Special Education and certificates to teach Bilingual and Gifted Education. Her research focuses on neurodiversity and creativity in education and research methods. She draws on creativity theory, disability studies in education, the neurodiversity paradigm, process philosophy and arts-based methods while working with others towards post-oppositional educational transformation. Mrs. Vasquez is also co-editor for *Writing and the Articulation of Qualitative Research*, to be published by Routledge late 2022.

#### F. Sha Xin Wei (*he, him*)

Sha Xin Wei (Ph.D., Stanford University) is Professor at the School of Arts, Media + Engineering and the School of Complex Adaptive Systems, and directs the Synthesis atelier for transversal art, philosophy and technology at Arizona State University. He is an associate editor for *AI & Society*, and serves on the Governing Board of Leonardo. Dr. Sha's core research concerns poiesis, play and process. His art and scholarly work range from gestural media, movement arts, and responsive environments through experiential design to critical studies and philosophy of technology. Sha's publications include *Poiesis and Enchantment in Topological Matter* (MIT Press).

### ACKNOWLEDGMENT

This panel is organized with funding from the National Science Foundation (NSF), grant CSforAll-2122924. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the moderator or panelists and do not necessarily reflect the views of the NSF.

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