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NEURODIVERSITY AS A BASELINE IN STEM EDUCATION RESEARCH

DEVELOPING COMPUTATIONAL THINKING SKILLS BY CO-DESIGNING CREATIVE
WEARABLE MUSIC DEVICES

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STRUCTURE OF THIS PRESENTATION

- PRESENTER INTRODUCTIONS
- PROJECT INTRODUCTION
- IMPLICATIONS
- PROJECT VIDEOS
- GUIDED ACTIVITY
- Q&A

PRESENTERS

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SCHOOL OF ARTS, MEDIA & ENGINEERING

MUSICAL INSTRUMENT DESIGN AND DEVELOPMENT
SIGNAL PROCESSING AND EMBEDDED SYSTEMS

RESPONSIBLE FOR CONCEPTUAL AND TECHNICAL
DEVELOPMENT OF MUSICAL WEARABLES FOR THIS
GRANT PROJECT



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NEURODIVERSITY EDUCATION RESEARCH CENTER/SCIENCE PREP ACADEMY

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ASU/ NERC RESEARCH PARTNERSHIP LIAISON

RECRUIT AND ON-GOING COMMUNICATION WITH TEACHER FELLOWS

CODESIGN WORKSHOPS WITH TEACHER FELLOWS AND ASU TEAM

MUSIC & STEM



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QUALITATIVE RESEARCH METHODOLOGIST

RESPONSIBLE FOR THE QUALITATIVE ASPECTS OF THE RESEARCH
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RESEARCH ASSISTANT- DATA COLLECTION, DATA
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NEURODIVERSITY AND CREATIVITY IN EDUCATION AND
RESEARCH METHODS



BACKGROUND AND PURPOSE

STEM EMPLOYERS ARE HIRING NEURODIVERGENT EMPLOYEES

STUDENTS ARE NOT PREPARED FOR NEEDED WORKPLACE SKILLS (ROUX ET AL., 2015; SHATTUCK ET AL., 2012)

STUDENTS DO NOT HAVE EXPERIENCE MERGING CREATIVITY, ARTISTIC FIELDS WITH STEM (LIAO, 2016)

THE PURPOSE OF THIS PRESENTATION IS TO HIGHLIGHT ONE EXAMPLE OF HOW THESE ISSUES ARE BEING ADDRESSED.

COMPUTATIONAL THINKING SKILLS DEVELOPMENT THROUGH THE CO-DESIGN OF CREATIVE WEARABLE MUSIC DEVICES BEGINS WITH A FOUNDATION IN THE NEURODIVERSITY PARADIGM.



PERSPECTIVES

- NEURODIVERSITY PARADIGM (SILBERMAN, 2016; WALKER, N.D.)
- INCLUSIVE STEM EDUCATION (BURGSTAHLER & LADNER, 2006; LADNER & STEFIK, 2017)
- EMBODIED COGNITION (BARSALOU, 2008; FYFE ET AL., 2014; THOMPSON MASSARO, 1994; GRASSMAN & TOMASELLO, 2010)
- NEURODIVERSE MIDDLE SCHOOLERS, INCLUDING THOSE LABELED WITH AUTISM
- MUSIC (ART) IN STEM (DE JAEGHER & DI PAOLO, 2007; LIAO, 2016)
- CO-DESIGN OF TECHNOLOGY AND PEDAGOGY (KRITSIS ET AL., 2018; SYNTHESIS, 2021; THORN ET AL., 2019; TOMAS, 2020)

TECHNOLOGY CO-DESIGN: YEAR 1

YEAR 1:

- DEVELOP SET OF SKEUOMORPHIC INSTRUMENTS (RAINSTICK, CLACKER, CATAPULT) FOR UNDERSTANDING IMU FEATURES MUSICALLY. “WEARABLE JAZZ” AS COLLECTIVELY PLAYABLE INSTRUMENT.
- TFs BRING KITS OF SENSORS AND LAPTOP TO CLASSROOMS. FOCUS ON AFFECTIVE EXPERIENCES FOR STUDENTS THROUGH SONIC AUGMENTATION OF MOVING. ITERATE AND ADAPT BASED ON EXPERIENCES AND FEEDBACK.
- ORGANIZATION OF WORKSHOPS: FROM SINGLE FEATURES TO COLLECTIVE FEATURES, AD HOC EMBEDDED PROTOTYPES, AND GROUP CHOREOGRAPHY.

TECHNOLOGY CO-DESIGN: YEAR 2

- RE-ARTICULATE CODING/CS/CT/ ELEMENTS
- TRACTION FROM EXPLORATION OF FOLEY EXERCISES WITH TEACHING FELLOWS. SCAFFOLDING
 - SELECTION OF FEATURE (CHANGE IN ANGLE, SHAKING, ROLLING, BUTTON PRESS)
 - CREATION OF CORPUS (SOUNDS AND SYNTHESIS)
 - TUNING THE INSTRUMENT (REPEATING, RANDOM, LOOPING, FILTERING, SCALING)
 - ATMOSPHERICS (ECHO, TREMOR CLOUDINESS)
 - PERFORMANCE: FOLEY IS COORDINATED *GROUP EFFORT*
- CURRICULUM DEVELOPMENT (KITS) BY TEACHING FELLOWS ACCORDING TO AREAS OF SPECIALIZATION LEADING TO YEAR 3 DEPLOYMENT AT SCALE

CO-DESIGN OF TEACHING PRACTICES

- 4 TEACHER FELLOWS
- MULTIMODAL, STUDENT-DIRECTED EXPERIENCES (EMBODIED, ENSEMBLE, CREATIVITY)
- COMPUTATIONAL THINKING SKILLS FOCUSED (AHO, 2012; JONA ET AL., 2014; KAFAI & BURKE, 2014; WING, 2006)
- CROSS-CURRICULAR
- CREATIVITY, COLLABORATION, PROBLEM SOLVING
- PERSONAL WELL-BEING



IMPLICATIONS: INCLUSIVE DESIGN

- WORKING ACROSS DIFFERENT CONTENT AREAS AND CONTEXTS (UNIVERSITY AND SCHOOL)
- NEURODIVERSITY AS A BASELINE
- TARGETS STUDENTS WITH AUTISM BUT THE WORK IS INTENDED TO REACH WIDER AUDIENCE
- APPLICABLE FOR ALL TEACHERS IN SOME WAYS
- MERGES DIFFERENT MODES OF EXPRESSION



IMPLICATIONS: MENTAL HEALTH & WELLNESS

- FOREGROUNDING THE SENSORY AND EMOTIONAL
- INQUIRY PLAY AND CREATIVITY
- INTERSECTION OF CULTURE/ARTS/DISABILITY/MENTAL HEALTH
- SELF MANAGEMENT EXPERIENCES AND PRACTICES
- MORE HOLISTIC STUDENT SUPPORT



IMPLICATIONS: WORKPLACE & EMPLOYMENT

- DEVELOP WORK-BASED SKILLS THAT ARE NEEDED TO SUSTAIN EMPLOYMENT
- ADVOCATE FOR NEURODIVERSE WORKPLACES AND JOB TRAINING
- PROFESSIONAL DEVELOPMENT FOR TEACHERS AND FUTURE EMPLOYERS



NTEL VIDEOS

GUIDED ACTIVITY

DISCUSSION AND Q&A

- FOCUS QUESTIONS ON THE “ART” OF NEURODIVERSITY:
 - HOW MIGHT THIS PROJECT CHALLENGE STEREOTYPES?
 - HOW DOES THIS PROJECT ENGAGE IN CREATIVE METHODS OF SUPPORT, ENGAGEMENT, RESEARCH, AND/OR PROGRAMMING?

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