



Designing STEM Experiences to Embrace Neurodiversity

edge
at TERC

TERC

Because math and
science build futures

Our Team



Jodi Asbell-Clarke



Kelly Paulson



Tara Robillard



Ibrahim Dahlstrom-Hakki



Teon Edwards



Erin Bardar

What is Neurodiversity?

Differences in brain function that are often diagnosed as autism, ADHD, dyslexia, and other learning differences

Differences in how people think and learn

Natural variation in brain function

Neurodiversity and STEM Connections

Detailed Pattern Recognition	.....	Cybersecurity
Systematic Thinking	.....	Programming and Debugging
Creativity	.....	Design
Spatial Reasoning	.....	Mapping and Modeling
Persistence	.....	Problem Solving
Connecting Ideas	.....	Innovation

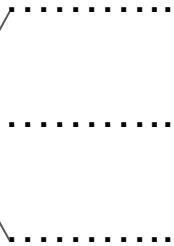
Neurodiversity as a Competitive Advantage



Challenges Associated with Neurodiversity



Executive Function



Sensory

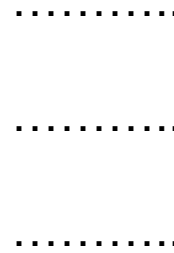
Attention

Social

Working Memory

Cognitive Flexibility

Inhibitory Control



Planning and
Organization

Metacognition

Attention and Emotional
Regulation

Strategies for Including Neurodivergent Learners in STEM

Learner Agency

Autonomy of Thought

Multiple Entry Points

Multiple Avenues to Success



Project-Based Learning

Game-Based Learning

Process-based Assessments

Focus on Areas of Strength

Computational Thinking



CREATIVE TECHNOLOGY
RESEARCH LAB
COLLEGE OF EDUCATION
UNIVERSITY OF FLORIDA



INFACT

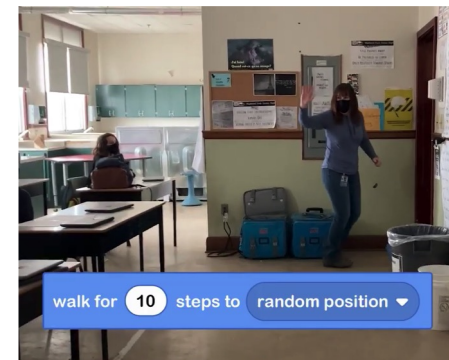
Including **N**eurodiversity in
Foundational and **A**ppplied
Computational **T**hinking

in Grades 3-8

Supported by the Education Innovation and Research Program (EIR) of the
U.S. Department of Education under award U411C190179

INFACT

Including Neurodiversity in Foundational
and Applied Computational Thinking





Including Neurodiversity in Foundational
and Applied Computational Thinking

Sample: 1009 students in grades 3-8

Treatment Group: Used INFACT materials for 10-week instructional period.

Control Group: Used other CT materials for 10-week instructional period.

Measures: EF Screeners, CT pre- and post-test



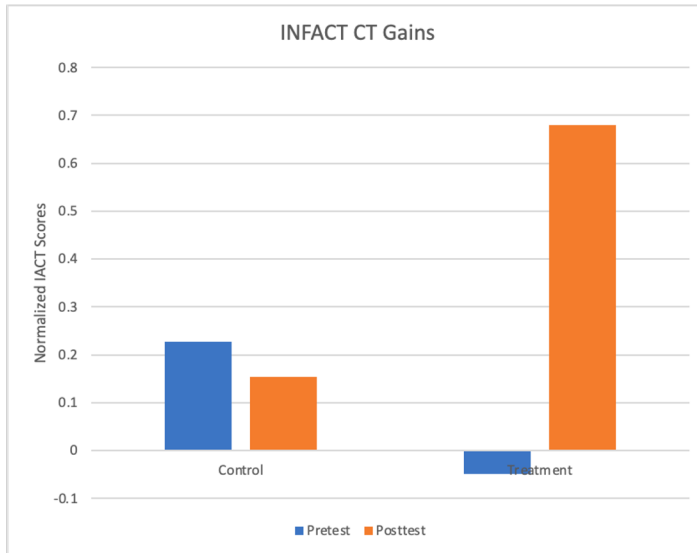
Including Neurodiversity in Foundational
and Applied Computational Thinking

Efficacy Study

Results: Average CT scores for students in classes using INFACT were one-third of a standard deviation higher ($\beta = 0.32$) higher than average scores for students in classes using other CT programs ($p = 0.03$).

Sample of same size would have a 55% chance of reproducing the same results.

Neurodiversity (Executive Function) Study



Results: Students who scored on the lower quartile on the EF screener pretest times (ACE) showed dramatic gains from pre to post on the CT assessment (IACT). This gain was also significant for the second lowest quartile of EF pretest scores.



Including Neurodiversity in Foundational
and Applied Computational Thinking

We are Looking for Partners!

- Schools and Districts wanting to support inclusion of neurodiversity in STEM
- Classroom teachers in grades 3-8 with inclusive classrooms ($\geq 20\%$ IEP or equivalent)
- Community Groups looking for rich educational materials for neurodivergent learners
- Great professional growth opportunity and recognition for educators
- Help districts achieve *their* goals

STEM for All Multiplex: Embracing Neurodiversity in STEM

UniVRsal Access:

Participation in Informal STEM Learning for Autistic Learners and Others through Virtual Reality

January 24, 2023

Teon Edwards



This material is based upon work supported by the National Science Foundation under Grant #2005447. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Co-Design:

Designing a Virtual Reality Game *With and For* Neurodivergent Learners

- STEM – Science, Technology, Engineering, and Math
- SAS – Sensory, Attention, and Social Differences
- Co-Design Directions

Europa Prime

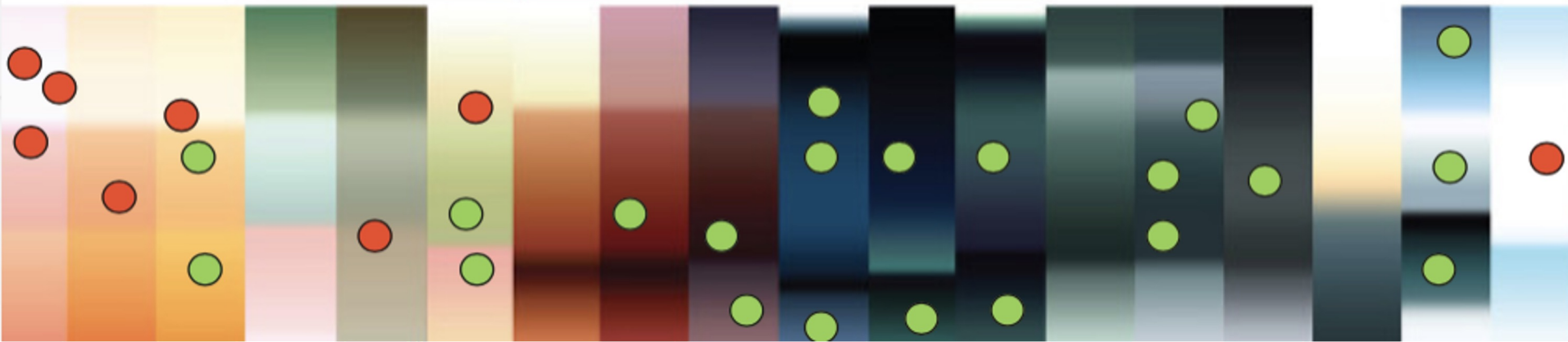
- You wake up on a space station on Europa, an icy moon of Jupiter.

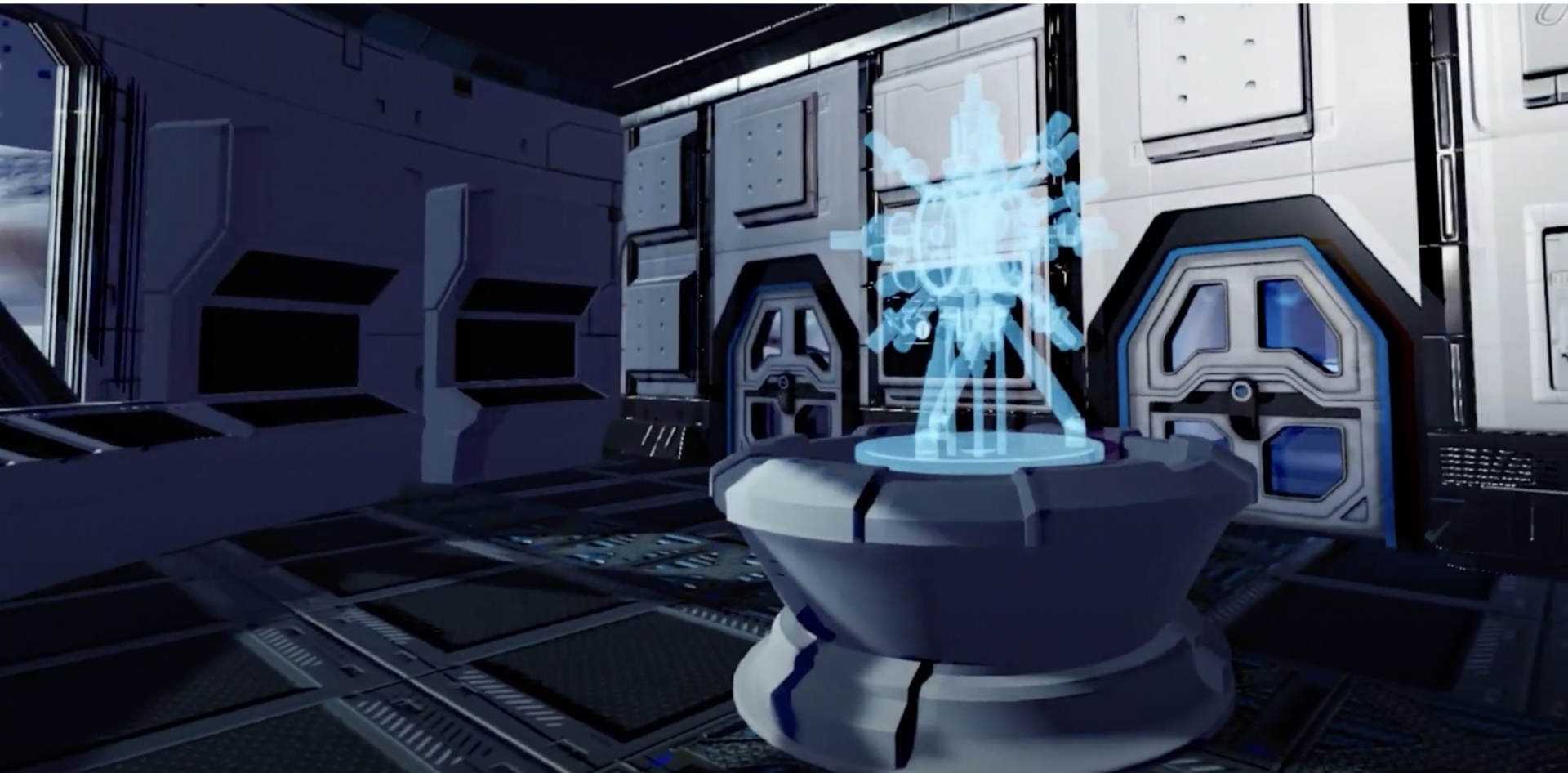


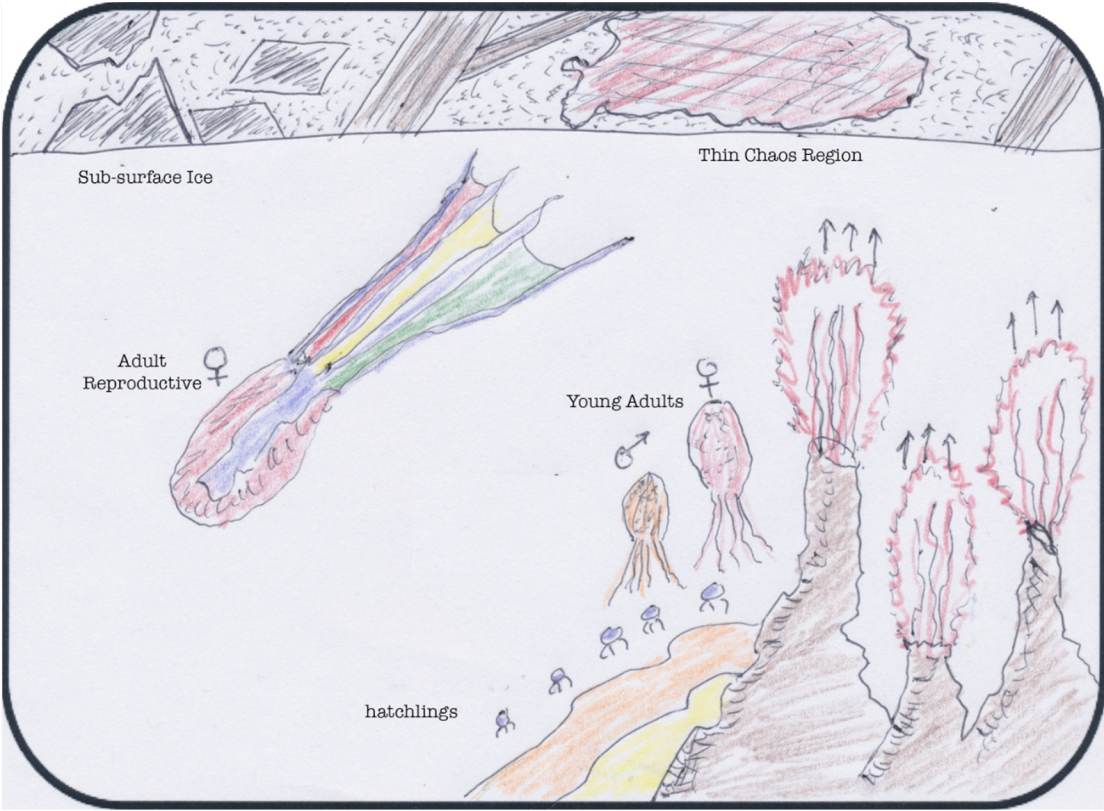
- Power is offline, and alien life fills the subsurface ocean.
- You must solve puzzles and complete tasks, large and small, to get the station and its research up and running.

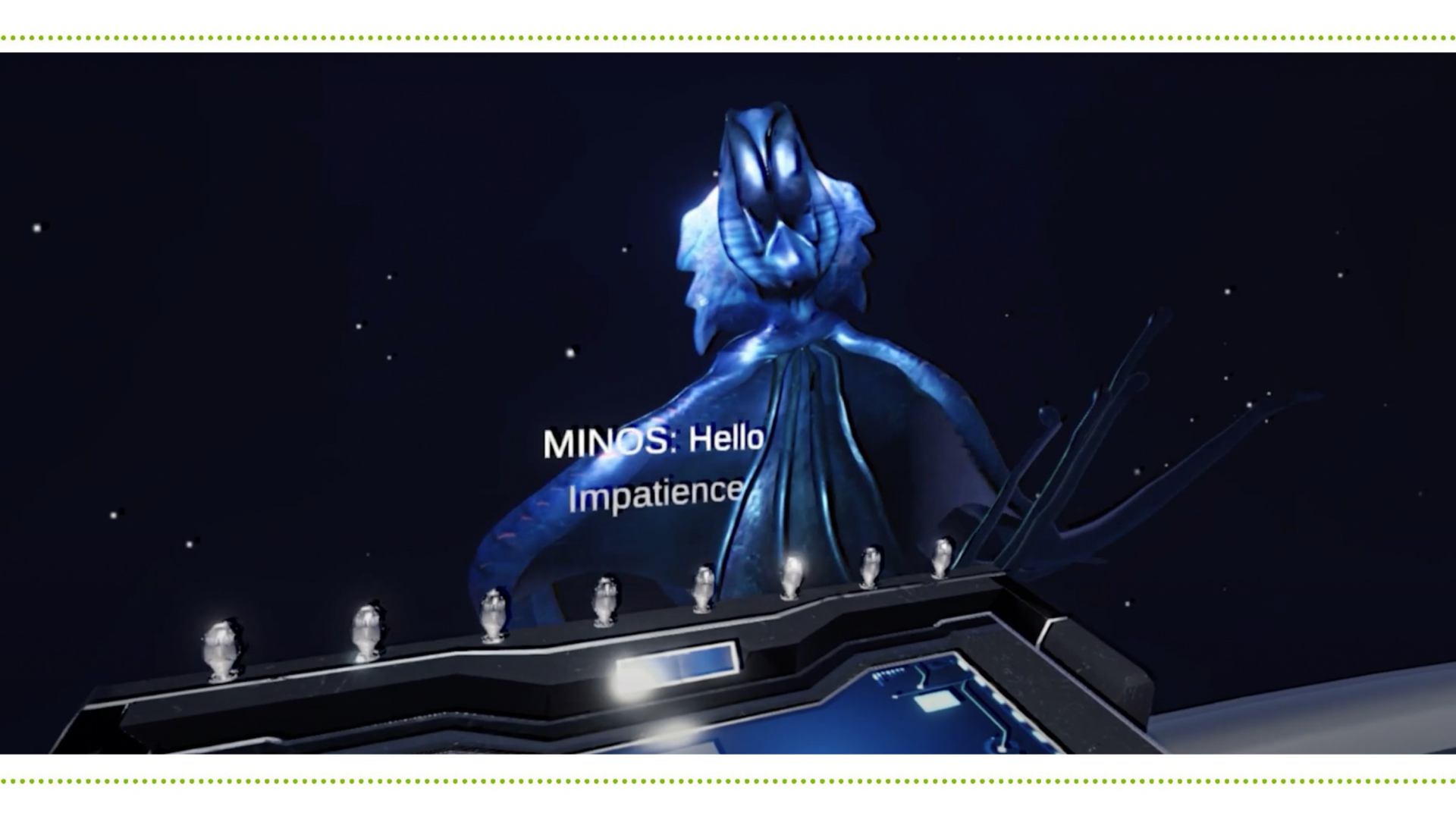
What Does This have to do with SAS and Neurodivergent Learners?

- VR cuts a participant off from the real world
- Not necessarily ideal for STEM learning
- Designers get to control much of a player's sensory, attention, and social experiences
- Design a STEM-learning experience that works for a broad audience, including neurodivergent players









MINOS: Hello
Impatience

Contact Us

E-mail edge_admin@terc.edu

TERC terc.edu/edge/contact

 [@EdGE_at_TERC](https://twitter.com/@EdGE_at_TERC)

 [@EdGEatTERC](https://facebook.com/@EdGEatTERC)

jodi_asbell-clarke@terc.edu