How Can We Effectively Engage Autistic Teens in Online Learning Opportunities?:
Use Universal Design but Remember it is a Process and Should be Student Interest Driven

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BACKGROUND

Autistic people are often chronically underemployed[1] despite interest in computers[2] *and* the growing need for computing professionals.[3]

Efforts to improve autistic people's employment outcomes should not *just* focus on computing, given their diverse career aspirations.[4]

However, computing is a path toward employment for *some* autistic people. Universal Design (UD; providing multiple options to engage diverse learners) and informal learning opportunities may help disabled students succeed in technology-related careers,[5] and could help autistic youth develop employment-related skills. That said, research with non-autistic people suggests that UD can sometimes overwhelm learners with redundant information. [6]

OBJECTIVE **Iteratively develop instructional to engage autistic learners through a game design workshop with informal STEM opportunities**

HYPOTHESES

1. Students with more focused attention would prefer unimodal instruction, whereas those with less focused attention would prefer multimodal instruction.
2. Workshops would lead to improved STEM self-efficacy and self-determination.

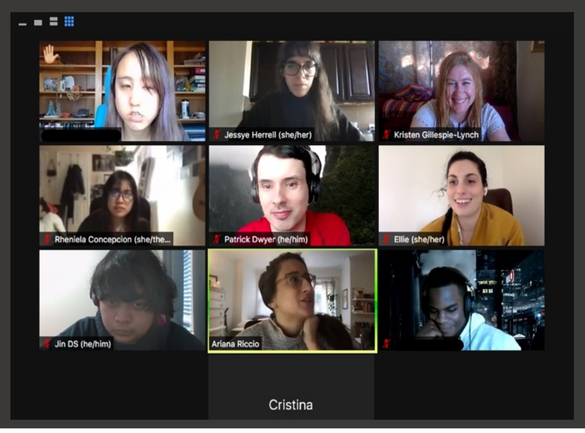

Figure 1 (*left*) The participatory team collaborates to discuss adaptations to curriculum for Workshop 2.
Figure 2 (*above*) Engagement scale used by students to rate how interested they were in the probed activity.

METHODS

Two virtual 2-week game design workshops were conducted at TKU, an informal technology education non-profit. Students made games, discussed career opportunities, and social justice issues.

20 students enrolled in each workshop, yet 2 students did not complete each workshop and 2 students had communication challenges and thus did not provide feedback in the 2nd workshop. The final sample included: Workshop 1 (July 2021): *n*=18, M_{age}=17.1; 66.7% White; Workshop 2 (August 2021): *n*=16, M_{age}=16.2; 68.8% White).

Assessments were developed by a participatory team and piloted with autistic teens from TKU. Pre- and post-tests assessed video game self-efficacy, self-determination, and computational thinking. Cambridge Brain Sciences games assessed inhibition, spatial planning, deductive and grammatical reasoning, and memory. Workshop 1 informed adaptations for Workshop 2.

Students rated engagement with probed activities including varied group sizes, activity types, and modalities, using an adapted picture-based engagement scale, assessing interest and understanding.[7]

PROBED ACTIVITIES

GROUP SIZE: Individual, Small Group, Whole Group
ACTIVITY TYPE: Play, Making, Social Justice Discussion, Individual Choice
INSTRUCTIONAL MODALITY: Voice only, Video + Voice, Video + Voice + Text, Demo + Voice, Demo + Voice + Text

Summer 1 student feedback guiding Summer 2 revisions

***Student 1**: "In week 1 there was lot of player choice and nitty gritty on the player level but because of the short time with Flowlab, there was not enough time to implement many of the things learned in week 1."*

***Student 2**: "The goals of them are too different. Twine tries to teach how to tell a story…Flowlab to build mechanics. In Flowlab I was able to let my mind wander but didn't have time to do it in Twine."*

***Student 3**: "I think Twine should stay- I'm pretty sure it is pretty fun and I like it a lot."*

→ **Currently, student discussions are informing which game engines we will use for Summer 2.**

RESULTS

Participants trended toward expressing less interest in and self-efficacy about video games in Workshop 2 than Workshop 1 (*p*s < .1).

A repeated measures GLM revealed differences in student-reported interest based on modality of instruction, $F(2, 54) = 5.47$, $p = .007$. Follow-up *t*-tests revealed higher interest in video + voice than both voice only and voice + video + text-based instruction (*p*s < .006). However, no associations between observed or parent-reported attention and modality preferences were observed, *p*s > .12.

Indeed, attentional and cognitive skills were rarely associated with engagement. The most consistently observed positive correlations with student **interest** in probed workshop activities were with pre-test **interest in learning job skills** and **self-determination**.

A repeated measures GLM revealed improvements in self-determination ($p = .009$) and spatial planning ($p = .005$) across workshops. Interactions between outcomes and workshop were not significant (*p*s > .12), suggesting improvements across workshops. However, improvements were only significant for Workshop 1. Video game and career self-efficacy did not improve (*p*s > .1).

Post-workshop interviews revealed that students largely enjoyed the workshops. Three students from 2021 workshops are now a part of our participatory group to help guide curricular adaptations for the summer workshop in 2022 (see paraphrased feedback above about Twine and Flowlab, the two game design platforms taught in Summer 1).

CONCLUSIONS

✓ **Choices for students are good, but more is not always better**
Evidence of Mayer's redundancy principle[6] was exemplified in students' preferences for instructional styles with some but not too many choices, suggesting the need to improve the meaningfulness of engagement ratings, use these ratings as a self-advocacy tool for ongoing curricular adaptations, and operationalize teaching constructs for clearer and more consistent assessment.

✓ **Teaching to students' interests and promoting a sense of agency likely increases engagement**
Students' interest in workshop objectives, particularly in learning job skills, and self-determination were associated with interest in activities during the workshop.

Unexpectedly, adaptations for Workshop 2 did not lead to improved outcomes, likely because students in Workshop 2 were less interested in workshop topics and had more varied skills (including 2 students with home caregivers).

This coming, summer we are revising the student screening to assess foundational skills and develop the curriculum guided by their interests, a priori, while using engagement ratings for iterative revisions.

✓ **Online informal tech workshops can empower students and support pivotal skill development**
Improvements in self-determination, which is associated with better employment and educational outcomes for autistic youth, suggests that informal learning communities can empower autistic youth to achieve their goals.

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