




## No Cameras, No Problem: Creating an Inclusive Research-Driven Classroom Environment Using Student-Generated Avatars

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### INTRODUCTION

In response to the unprecedented impact of the COVID-19 pandemic, colleges and universities nationwide were forced to shift abruptly to remote instruction, leading to variable levels of student learning and overall success (1–3). Instructional outcomes resulting from this shift were further influenced by the extent to which educators and students engaged with course material and with each other, among a suite of factors. Within the online environment, engagement can vary extensively from posting contributions to a discussion board to participating in sustained collaborative work, though a frequent theme among these experiences is the desire of students to be seen as individuals (4, 5). One means to achieve this goal is through the use of video cameras during synchronous course sessions. However, Castelli and Sarvary (6) note, for instance, that the majority (90%) of undergraduates enrolled in an introductory biology laboratory course at their institution self-reported leaving their video cameras off during one or more remote synchronous meetings. Participants provided a host of rationales for this decision, which ranged from Internet connectivity issues to concerns about their physical location being visible to their peers. Relatedly, recent research suggests that prolonged use of one's camera during videoconferencing events is positively associated with increased feelings of acute and chronic fatigue (7), and the carbon footprint generated by extended camera use can be quite severe (8). While these findings and considerations are not exclusive to virtual learning environments created solely in response to the pandemic—with continuous documented increases in student enrollment in distance education observed over the last decade (9, 10)—we affirm the importance of creating accessible and inclusive spaces wherein students and instructors feel connected to one another and wherein they can interact with each other around course themes and concepts (11, 12).

To that end, we developed and evaluated the *Researcher Avatar (RA)* activity for use in seminar and laboratory contexts, such as the ones described by Castelli and Sarvary (6) and Ott et al. (13). As described at further length below, the RA exercise is designed to prompt students to generate an avatar that represents how they view themselves as researchers and to briefly explain why they chose to represent themselves in that manner. Students then make use of these avatars during class as their videoconferencing profile pictures, which are visible when the students' cameras are turned off. In this way, students and instructors can “see” their peers without the need to mandate student camera usage. Accordingly, students can showcase their scientific researcher identities in a manner that is self-directed (rather than forced or constrained) and that has the potential to foster spontaneous conversation with their peers who may share similar identities, thereby supporting creation of a classroom community that celebrates the intersectional nature of students' identities and promotes their interests in STEM (14–16).

### PROCEDURES

#### Development of the RA activity

The RA activity (Appendix 1) consists of two sections: (i) generation of an image that represents oneself as a researcher; and (ii) discussion of how the image is a reflection of one's researcher identity, including a rationale as to why the image was generated or selected in the manner depicted. We intentionally adopted this structure to keep the exercise brief, yet informative, while likewise offering students maximum flexibility in constructing their avatar as they best saw fit (17–19). As an extension of the latter point, students had the option to make use of an existing image available on the Internet as their avatar. This ensured that all students, regardless of perceived artistic ability, could participate equally in the activity.

#### Instructions for implementation

We recommend that instructors deploy the RA activity during the first week of the term in order to provide students

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FIG 1. Student-generated avatars representing both traditional/stereotypical characteristics of a scientist (left) as well as personal attributes and research interests of the respondent (right).

with an early opportunity to reflect on their identity as scientific researchers. Furthermore, we advise instructors to be explicit about why they are implementing the activity and the potential affordances of doing so, particularly in the context of an online learning environment, as this will ideally increase student receptivity to the exercise (20). At our institution, students completed the activity as a homework assignment and uploaded their work to our Learning Management System (Blackboard Learn). The instructor (C.E.D.) then strongly encouraged students to display their avatars throughout the semester in instances where they did not make use of the cameras on their devices and provided verbal guidance on how to assign the avatar as their profile picture on the video-conferencing platform (Blackboard Collaborate). Despite the use of this delivery format in our context, we contend that the activity could be implemented in a diversity of ways, including as part of an in-class lesson. If done in this manner, several follow-up prompts could be posed to students, such as:

1. How would your avatar potentially change if you were asked to complete the assignment for a different course?
2. Take a moment to observe those avatars created by your classmates. What similarities or patterns do you notice among your peers' avatars?
3. What did you find most enjoyable about this exercise? Challenging? Why?

Regardless of the mode of implementation, it is important to note that no prior knowledge or skills are required of the instructor and students in order for them to deploy and complete this activity, respectively. Furthermore, in alignment with the formative nature of the RA exercise, we strongly recommend that the activity be graded on the basis of completion (rather than some performance metric), if a grade is to be awarded.

## SAFETY AND PRIVACY CONCERNS

There are no safety concerns associated with this activity. However, given that the exercise is likely to elicit personal information from students, we caution instructors to be cognizant of respecting students' privacy.

## EVALUATION AND DISCUSSION OF STUDENT SUBMISSIONS

While the COVID-19 pandemic necessitated a rapid transition to remote instruction, the prevalence of online STEM curricula has continued to increase over the last several decades (9, 10). Accordingly, the importance of providing an accessible and inclusive virtual environment for students at all academic levels cannot be understated. This, we contend, is especially true given recent research documenting students' use (or lack thereof) of visual technologies in online spaces (6).

To better understand how students approached the RA activity, visual and written responses provided by individuals ( $N=24$ ) enrolled in an online, freshman-level Research Foundations Course in the Spring 2021 semester were qualitatively evaluated. This course met in a synchronous format twice weekly for 80 minutes each session. Specifically, content analysis of avatar images ( $n=22$ ) was performed to identify the extent to which those images represented traditional depictions of scientific researchers, personal attributes of the students, and/or non-self visualizations. Each image was first blinded and then coded by two researchers with expertise in biology education (J.T.O. and L.G.), achieving strong interrater reliability ( $\kappa = 0.912$ ;  $P < 0.001$ ; 95% CI [0.814, 1.000]). Results indicated that students most frequently included personal characteristics in their avatars (76% of responses) followed by traditional or stereotypical imagery (33% of responses) and then non-self depictions (19% of responses) (Fig. 1). Note that

TABLE I  
Qualitative analysis of students' written responses describing their avatar images

Theme	Number of responses (%) <sup>a</sup>	Sample student response
Positive affect toward science	13 (54%)	"This drawing I made represents my passion for computer science and the field of tech."
Being approachable or collaborative	9 (38%)	"I hope my classmates see that I am a very kind, caring, and very outgoing [person]. . . and, most importantly, a team worker as well."
Contributing to the greater good	5 (21%)	"Helping others heal has always been important for me, so I am very interested in researching new ways to give people with injuries or health conditions an easier, more efficient healing process."
Dedication to science	16 (67%)	"What I hope for my classmates to see while viewing my avatar is that research can consume an individual and you can sometimes become the research in the best of ways."
Open-mindedness/curiosity	11 (46%)	"This image symbolizes the endless opportunities I am thinking about when it comes to collecting, organizing, and analyzing all the possible data in the world."
Counterstereotypical images of scientists	2 (8%)	"I have piercings, and people like [to] make assumptions [about] who I'm supposed to be because of them, but I like to prove them wrong and be a strong, educated female. . . to be who I am and do what I love and not listen to stereotypes."
Future career interests	11 (46%)	"I would like to be a data scientist and work with big data, machine learning, and AI."

<sup>a</sup>N = 24; student responses were coded into multiple categories, as appropriate.

a given image could be coded under multiple categories; thus, the percentages indicated in the previous sentence do not sum to 100%.

Thematic analysis of blinded written submissions was subsequently conducted by two researchers with expertise in biology education (J.T.O. and L.G.). This entailed iterative rounds of inductive coding to identify patterns in participant responses (N = 24) (21). Strong interrater reliability was achieved ( $\kappa = 0.889$ ;  $P < 0.001$ ; 95% CI [0.819, 0.959]), with all disputes resolved through discussion between the coders. Data suggested that the majority of individuals (67%) wanted their avatar to reflect their dedication to science and/or their positive affect toward science (54% of responses). To a slightly lesser degree, students also created or selected avatars that they felt portrayed their open-mindedness or inquisitiveness as well as their future career intentions (46% of responses for each theme). A complete list of themes and sample student responses are provided in Table I.

At the end of the semester, students were asked to informally provide feedback on the overall utility of the RA activity. One student noted that "having the avatar in this course, in particular, aided [them] in seeing what other students are interested in and/or how they see themselves." This, a second student stated, was especially important in an online environment because "you cannot see anyone, so the avatar really allowed one to understand other people and who they are without actually seeing them." On a more personal level, students also reported that the activity helped them explore more about themselves as researchers, with one individual

describing that the avatar was "a beneficial tool to [them], as it gave [them] expectations of [themselves] and what [they] hoped to incorporate into [their] own research work ethic." Collectively, these findings suggest that the avatar activity had practical value to the students while likewise achieving the overarching goal of creating a connected and inclusive classroom environment.

## SUPPLEMENTAL MATERIAL

Supplemental material is available online only.

**SUPPLEMENTAL FILE 1**, PDF file, 0.02 MB.

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