

Q&A: Artificial intelligence and the classroom of the future

20 November 2020, by Tessa Venell



Screenshot of the embodied avatar system "Diana."
Credit: Brandeis University

Imagine a classroom in the future where teachers are working alongside artificial intelligence partners to ensure no student gets left behind.

The AI partner's careful monitoring picks up on a student in the back who has been quiet and still for the whole class and the AI partner prompts the teacher to engage the student. When called on, the student asks a question. The teacher clarifies the material that has been presented and every student comes away with a better understanding of the lesson.

This is part of a larger vision of future classrooms where human instruction and AI technology interact to improve educational environments and the learning experience.

James Pustejovsky, the TJX Feldberg Professor of Computer Science, is working towards that vision with a team led by the University of Colorado Boulder, as part of the new \$20 million National Science Foundation-funded AI Institute for Student-AI Teaming.

The research will play a critical role in helping ensure the AI agent is a natural partner in the

[classroom](#), with language and vision capabilities, allowing it to not only hear what the teacher and each student is saying, but also notice gestures (pointing, shrugs, shaking a head), eye gaze, and facial expressions (student attitudes and emotions).

Pustejovsky took some time to answer questions from BrandeisNOW about his research.

How does your research help build this classroom of the future?

For the past five years, we have been working to create a multimodal embodied avatar system, called "Diana," that interacts with a human to perform various tasks. She can talk, listen, see, and respond to language and gesture from her human partner, and then perform actions in a 3-D simulation environment called VoxWorld. This is work we have been conducting with our collaborators at Colorado State University, led by Ross Beveridge in their vision lab. We are working together again (CSU and Brandeis) to help bring this kind of "embodied human computer interaction" into the classroom. Nikhil Krishnaswamy, my former Ph.D. [student](#) and co-developer of Diana, has joined CSU as part of their team.

How does it work in the context of a classroom setting?

At first it's disembodied, a [virtual presence](#) on an iPad, for example, where it is able to recognize the voices of different students. So imagine a classroom: Six to 10 children in grade school. The initial goal in the first year is to have the AI partner passively following the different students, in the way they're talking and interacting, and then eventually the partner will learn to intervene to make sure that everyone is equitably represented and participating in the classroom.

Are there other settings that Diana would be useful in besides a classroom?

Let's say I've got a Julia Child app on my iPad and I want her to help me make bread. If I start the program on the iPad, the Julia Child avatar would be able to understand my speech. If I have my camera set up, the program allows me to be completely embedded and embodied in a virtual space with her so that she can help me.

1 year project, and it's getting off the ground. This is exciting new research that is starting to answer questions about using our avatar and agent technology with students in the classroom.

Provided by Brandeis University

How does she help you?

She would look at my table and say, "Okay, do you have everything you need." And then I'd say, "I think so." So the camera will be on, and if you had all your baking materials laid out on your table, she would scan the table. She'd say, I see flour, yeast, salt, and water, but I don't see any utensils: you're going to need a cup, you're going to need a teaspoon. After you had everything you needed, she would tell you to put the flour in "that bowl over there." And then she'd show you how to mix it.

Is that where Diana comes in?

Yes, Diana is basically becoming an "embodied presence" in the [human-computer interaction](#): she can see what you're doing, you can see what she's doing. In a classroom interaction, Diana could help with guiding students through lesson plans, through dialog and gesture, while also monitoring the students' progress, mood, and levels of satisfaction or frustration.

Does Diana have any uses in virtual learning in education?

Using an AI partner for virtual learning could be a fairly natural interaction. In fact, with a platform such as Zoom, many of the computational issues are actually easier since voice and video tracks of different speakers have already been segmented and identified. Furthermore, in a Hollywood Squares display of all the students, a virtual AI partner may not seem as unnatural, and Diana might more easily integrate with the students online.

What stage is the research at now?

Within the context of the CU Boulder-led AI Institute, the research has just started. It's a five-

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