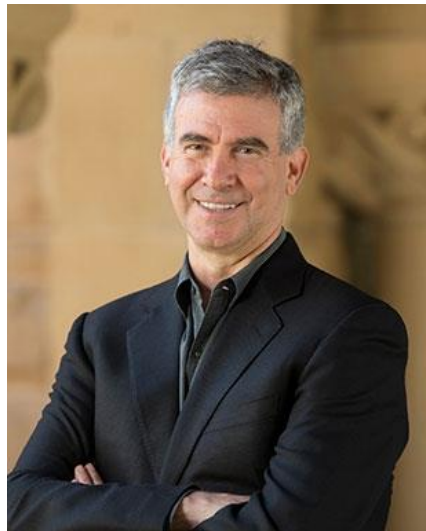


## Interdisciplinary connections: An interview with Dean Dan Schwartz

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Daniel Schwartz currently serves as the I. James Quillen Dean of the Stanford School of Education. He earned his bachelor's degrees in Philosophy and Anthropology at Swarthmore College and Teaching Certificate at the University of Southern California, serving as a secondary school teacher in schools in California, Alaska, and Kenya. In 1988, Dr. Schwartz earned a Master's Degree in Computers and Education at Columbia University before shifting his focus to Human Cognition and Learning in his doctoral studies at Columbia University. As the

Nomellini & Olivier Professor of Educational Technology at Stanford University, he also directs the AAA Lab focused on designing and evaluating educational technologies and theories of learning and is the author of numerous journal articles, chapters, and books including a 2016 NPR best book, *The ABCs of How We Learn: 26 Scientifically Proven Approaches, How They Work, and When to Use Them*.

*Biography adapted from and photo from Daniel Schwartz's curricula vitae and profile at <https://ed.stanford.edu/faculty/danls>.*

RNA: Through the AAA Lab, your research has developed and evaluated various education technologies for STEM education. How has technology changed how students learn about science?

DS: I think we are still deciding how to do this. We made a technology called a Teachable Agent where a student teaches a computer program that has some artificial intelligence and based on what the student teaches the agent, the computer can then answer questions. This is a great way for students to learn science and we just couldn't do it without technology. [Physics and Education] Professor Carl Wieman has made simulations of things that students are not going to have direct access to, like optical tweezers or glaciers. You can play with different variables to see how things change. You couldn't do that without technology. There are lots of ways to teach that you just couldn't do before, and this is one of the great aspects of technology. How to do it well? Still figuring it out. There are other types of technologies that are doing very traditional things in teaching, but are just more efficient at it. There are a lot of those, and they can be really helpful: games that help students memorize math facts for example. What the technology adds is lots of feedback and repetition. That is something we can do well, but technology makes it more efficient. What I am hoping is that more of the creative uses - doing things that couldn't be done without technology -- are being developed.

RNA: As the Dean of the school of education, you have the opportunity to foster collaborations between educators, technology experts, and psychologists. What insights come from such interdisciplinary collaboration for the field of education?

DS: I think education needs more interdisciplinary work. We have economists who do great policy work and they may discover what kind of implementation in classes works the best, but they don't know why because they are not talking to psychologists. The [psychologists] know how these things work, but they don't know if they can happen at scale, which is what the economists are very good at. So you want them to talk to each other. We are trying to build programs where you get interdisciplinary teams working on problems because most educational problems are an interdisciplinary problem: it is social, it is psychological, it is financial, it is race, it is language, so you really want teams that are interdisciplinary. A second type of collaboration that most people don't think of is how to get world-class researchers to interact with practitioners who generate questions from the field.

We have a very unique partnership with the San Francisco Unified School District where the leadership sets a couple questions they would like us to answer and some faculty step up and do it. The place that technology shows up here is the data. The data is now warehoused and it is technologically available so what you have is faculty who are doing

studies that help the district make local decisions while at the same time introducing high impact knowledge. We call this kind of collaboration, “reciprocal translation.” Both sides are helping each other. We are now scaling so we can do this with Redwood City, Ravenswood, Portola Valley, Menlo Park, Sequoia, and some other neighbors to see if we can get kind of collaboration - so it’s not interdisciplinary in the sense that sociologists are working with economists, but interdisciplinary in the sense that people who see different pieces of the elephant get the chance to work together.

RNA: In addition to research, there is a growing interest in teaching and learning interdisciplinary studies such as science, technology, and society, symbolic systems, and human biology at Stanford. What role do you think this type of education has on preparing students for future work or study?

DS: The great value of this interdisciplinary education is that it prepares you to learn things in the future. You are going to go out and you are going to take a job and you are going to learn a lot in that job and you are going to change jobs, and the world allows you to change. An interdisciplinary education helps you identify key issues so that you can organize your future learning: you can say this [question] both has a statistical component and a humanist aspect, and [this awareness] helps you to make sense of new information and keep learning.

It teaches you to collaborate with people who are not experts in the same area that you are. I’ve collaborated with neuroscientists, communications professors, medical professors, and I think I’ve gotten better at learning at how to do this interdisciplinary collaboration. I ask “Why is that important to you?” and then they start to explain and I start to understand from their point of view why that is significant. Once I understand, I can help bring in some of my knowledge to solve the problem. So it’s possible that the interdisciplinary experiences are helpful for students to learn to talk across disciplines, which is a big challenge. It’s possible that it provides something like liberal arts where you have a broad background so that as you learn new things you have these big concepts you can bring to bear.

RNA: What value do you think an interdisciplinary education can have in particular for students interested in science, technology, and computer science?

DS: You can do things you couldn’t do before. With technology, I can make very interesting art I could never have done another way. I was a philosophy major and then I learned cognitive psychology, but I learned programming and it allowed me to do things I was not able to do before. I was able to make new kinds of instructions and new kinds of measurement that also helped me create theories that were [supported] with the rigor of

computation.

RNA: What can educators do to help students make connections between technical and social fields in their study?

DS: The easiest way is to have projects and assignments where that's the task. One so-so way to do that in computer science is to show some algorithm and say this is how it worked on the stock market or this is how they decide the speed of traffic lights. More satisfying and compelling is if you have to use the technology to address some social situation in which you learn which aspect of the social situation can be modeled by the technical methods, or where you can figure out where a technological solution can be inserted and you think that's the best way to actually do it. That's not to say that I want a first year undergraduate who knows Java to say I now know how to solve poverty and go into some place and mess with all these people. You don't want that. There are ways to make educational experiences where [students] get the chance to think about how to use technology to make helpful things without risking harm, and making things to help people is pretty satisfying. It's kept me going for over 30 years!