



## NCTI 2010 Technology Innovators Conference

### ***Immersive Environments and Virtual Reality for Education***

**Matt Kaplowitz**, Founding Partner of [Bridge Multimedia](#) (Moderator)

**Paul Jesukiewicz**, Director, [Advanced Distributed Learning Initiative](#) (ADL),  
Office of the Secretary of Defense

**Daniel Schwartz**, Co-Director, [LIFE Center](#); Professor, Stanford University  
**Bonnie Brown**, Superintendent of District 75, New York City Department of  
Education

**Cara Coffina**, Coordinator of Applied Learning, District 75, New York City  
Department of Education

**Summary:** Speakers discuss innovative ways in which they are using virtual reality in education, as well as some research showing how virtual reality may help people learn.

### **Discussion**

#### **Matt Kaplowitz**

- Virtual reality is like many other technologies that have been discussed here. This past week I learned of some research being conducted that compares work groups that work physically together in one environment to workgroups that are spread out over large areas. The research that is coming back is that the performance outcomes are better for teams that meet virtually. The fact that a widely dispersed work group has the potential to be positive isn't new, we are already way past that. However, the research shows that there are better outcomes.
- The thing that puts it in context for the population of disabled learners is a double-edged sword, since individualized attention is better for them. However, a few years ago there was someone from <http://secondlife.com/> who showed its content could have a great impact.

#### **Paul Jesukiewicz**

- I look forward to giving you some idea of what we are doing in the Department of Defense (DOD). We invest heavily in virtual reality. For example, in the last few years we have invested in things like the Marine game version of Doom. I want to say where we are, where we are going, and how we could collaborate.
- We do work in education, and in collaboration with the Department of Education. We're trying to create something like an education version of the Defense Advanced Research Projects Agency (DARPA). A few years ago we started looking at advanced distributed learning. As the Internet came out, many people started putting things up but it wasn't clear what was good. We developed things like the Sharable Content Object Reference Model (SCORM).



- One of the areas we looked at was immersive learning technologies. There is a lot of gaming technology, virtual worlds, mobile and web 2.0. Not a lot of learning was happening at first, but we are a bit more focused on making that happen now. It's not an easy thing to do to get someone in a game to learn collaboratively. UCLA research is looking at tracking learners in immersive environment, so we can measure their performance while they play. In immersive learning, with defense work, we have to put up firewalls around second life, because of security concerns, which adds some difficulties. We are also doing "what-if" scenarios in war colleges and strategic learning events. There are some other games coming out: Marine Corps Doom, DARWARS, Gator.

There is not one game environment, there are many gaming environments. We have open source technology, off the shelf games, etc. When we look at the learner in these environments, there are technical issues, where people can communicate with each other. New game consoles coming out (e.g., Kinect) will change how we interact with these environments.

- As we want to personalize learning, how do we do that? How do I get access, but also protect privacy. We want some type of learning portfolio so we now where people are, but we need to protect people's privacy as well.
- Things like secondlife.com, or things that the U.S. Navy has created, see how it is used as tool and added to the curriculum rather than replacing it. They are looking at virtual decisions as a way to assess people, rather than questions. These are new skills that we can measure.
- The DOD is also doing language training in virtual reality using more scenario-based immersion of students to engage people. They are also doing more cultural education and language tied together in virtual reality. For example, the user is "dropped" into a city, and needs to dialogue with locals, so not just language, but body language as well. These can be played at some level on mobile devices. Also, Joint Forces command had a virtual cultural awareness trainer, which is used in Iraq and Afghanistan.

Role playing is a big part of this. Besides first person shooters, there are more cultural things that you can do. A ton of investment is going into these virtual worlds and 3D games are next.

- One thing we thought is that with this investment, we aren't sharing them necessarily. That is, we can't combine worlds from one virtual reality game to another. So, we created a 3D repository. The rationale behind this was that all content must be accessible and visible. For example, many companies are spending over 20 hours of modeling time to create things that are already created. This created a 3D content-sharing landscape. We pulled it together in a framework, so that if you create content in a 3D world, you can pull it into different software. Collaborate via ADA. We can then reuse content people are making. [3d-repositories@googlegroups.com](mailto:3d-repositories@googlegroups.com)



## Daniel Schwartz

- I was told to give a research talk, but I'll first talk about the LIFE Center. Our budget is a couple of million a year, which is used to understand learning in different situations. LIFE emphasizes the social part of learning. For example, we expose children to Chinese and English, and measure when they start to understand it. We had a Chinese speaker read a book to child and compared it to a child listening to a recording of a Chinese speaker. What we found was that the child learns when people talk to kids, not through TV or recordings.

So, we want to know, is it the social aspect of the interaction, or the contingent aspect of the interaction? We used immersive virtual reality to test this. In this study, you either thought you were talking to a computer character, or thought you were talking to a real person. However, in each case the study participant was talking to a computer character. This allowed us to measure the impact of belief in social interaction. The character appears in goggles. You say something, then the character answers. Goes blue – cycle repeats nine times. You're either told that this is a person you just met, an avatar, or that it's a computer agent. College students then did the same after playing a game with a new person, and were told the character is the person they just met. Then post-test. If you thought it was a person, you learned more.

- Arousal profile graph: Fact sorting. We then took all of the post-test questions where people didn't do well. For low score, there is lower arousal; if you are more aroused, you learn more. So, in virtual reality, if you think it's a person, you learn better.

We did it again, but instead, you read it silently, and then the character reads back. If its an avatar, you do best all around, if the avatar is silent, then easy questions are basically the same, but harder ones cause drops. When you believe it is an agent (a computer program), there are worse outcomes all around.

Learning is best when it's social and interactive.

- How do we bring this to a classroom? "Social" is a frame of mind. We can get students to do this by adopting and teaching a computer agent. This program allows kids to create a person, by literally drawing and mapping out connections in a virtual person's brain, so you essentially teach the virtual agent by creating their brain.

Agents can take a quiz and be on a game show where you wager on whether your agent will make it work. The only difference in the test is whether you think you are teaching an agent, or if you think it is yourself.

Kids spend more time teaching than trying to learn something themselves.



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- Do students become too dependent on technology? Does this technology displace the value of what was there before? FOSS example, half the teachers used the teachable agents, the others used their normal curriculum. This shows that there is added value in using the kit and the teachable agent. Kids do better on “why” questions. Kids who started using the teachable agent had increased learning. Results from study in virtual reality are changing learning theory and school applications. For more, see [Teachable agents and the protégé effect](#).

### **Bonnie Brown**

- A quick description of NYC DOE District 75 students:
  - We have students who were consistently involved in the justice system. They have emotional disabilities.
  - Now D75 has the largest group of students in the autistic spectrum.
  - 70% of students are not college bound.

We needed to get them ready for life in the world of work. We also knew that our kids do best with repetition and practice. It is necessary that we get them ready for life after school, where we hope that they will be independent and work-ready. The kids age out of the program at 21.

- We did some research on many of the neighboring districts. They were able to give these students an opportunity to actually go into the community, and to learn skills they need – activities and daily living school. These districts bought a house and taught living skills. NYC couldn’t go buy houses, especially given the cost of this in the city. But we wanted to give our students the same opportunities. However, it became more complicated, because there were so many who needed not just work skills but social skills as well.
- We spent a lot of time looking for a platform that would work with us. We had a ton of issues with secondlife.com – bandwidth and other technical problems. While many NYC schools have Internet access, the Special Education classrooms didn’t have the ability to connect to Internet. We had difficulty getting this together, and were told there was no way. However, I met the person in charge of the technology department, and he said he could set us up – and we made it happen.

We knew what students needed. We started thinking about making 3D worlds so kids could do all of this.

Many schools didn’t have enough girls in classrooms to deal with specific issues, so we started an online group for that. We’ve utilized the Internet to do a ton of this work. We’ll share some examples with it.

### **Cara Coffina**

- We had three main goals in this program:



- Building communication skills
- Building social skills
- Helping students be prepared for independent living
- Kinds of learning opportunities we used:
  - Joining interest groups
  - Personal banking
  - Going grocery shopping
  - Learning personal budgeting
  - Navigating and using the bus lines
  - Planning a block party

For example, with learning about personal banking, we did the following things: students visited a virtual bank, waited in a virtual line, and we had real staff members role-playing as avatars in the bank.

### **Bonnie Brown**

- Many of our students don't have experience with socialization. Parents don't let them out that much because it's not safe. But in our classes, the kids create avatars, and go out and negotiate life through that character. A lot of time is spent teaching them how to manipulate through the virtual world. A big part of it is learning how to have small talk.

It is very difficult to practice a lot of these things in real life. But the virtual world is a safe place for them to figure out how to do many things. They could do this on their own time, and then a teacher can look at it later with the kid and explain things. It allows them to learn, and fail, because it wasn't them, it was their avatar.

### **Discussion and Q&A**

**Question:** Did parents or teachers notice a difference?

- **Bonnie Brown:** Parents loved how excited their kids were about this. Some parents were a bit confused, because the kids would talk about doing these things like they actually did them, since the kids were telling them things with specific detail.

**Question:** Was this done on a virtual island?

- **Cara Coffina:** Yes, it was totally secure, we created all of the accounts. There are a lot of students who love it, and some who are in their second year are helping out the newer students. As far as I know they aren't logging in outside of



the school, we weren't necessarily encouraging it, because we wanted supervision.

- **Matt Kaplowitz:** I've seen this, it's impressive. You can hear a pin drop because of the level of focus, concentration, and involvement – it's amazing. The level of engagement is amazing.
- **Cara Coffina:** It's an amazing behavioral management tool. The learning curve is steep. Sometimes it was hard because teachers were resistant to learning, but often teachers learn from the student, and that empowers the student.

**Question:** I work with kids with vision impairments, I was wondering how you deal with that.

- **Cara Coffina:** We use the Smartboards as one way. Anyone with an assistive technology that works with the Internet can use this.

**Question** (Sarah Ivy, Vanderbilt University Peabody): So, we know that kids attend well to TV; I was looking at research out of Vanderbilt about how much they learned from TV. What do you think is going on that creates that stickiness between the child and TV? For secondlife people, given what we know about problems mentally disabled kids have with developing skills, are they generalizing the skills?

- **Daniel Schwartz:** Kids were quite engaged with TV, but not learning from it. The interactivity is key.
- **Cara Coffina:** Every week they are working on skills in a virtual world, and then assessing the same skill in the real world. We should have data to look at this soon.

[Second life example video, shows some examples of students learning how to open a bank account.]

**Question:** I have a question for the panel regarding the transfer of skills. Until schools pick up the idea of using virtual reality as a tool to teach language, they have to deal with textbooks and paper and pencil tests. But, when kids learn language in virtual reality, can the kids use the language in the virtual world?

- **Paul Jesukiewicz:** Yes, they had more real life experience just by doing this.
- **Daniel Schwartz:** Yes, in the example I talked about, the kids who played the game and then went and did paper and pencil work, those kids did better. The skills transferred over.

**Question** (Matt Kaplowitz, Panel Moderator): What are the current, off-the-shelf products in this era where everyone is broke, what is available in the most affordable forms? What would you recommend for people here to get?

- **Cara Coffina:** We had a lot of donated products to put this together.



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- **Paul Jesukiewicz:** My biggest goal has been open source, and I think that open source technology has helped lower the prices. It gives you the capability to do things and create things that you couldn't otherwise do. So, open source, Delta 3D, they are out there, but they are only as good as the community around it. Commercially you get support you won't get with open source, but you do have a community to help.
- **Daniel Schwartz:** The presentations showed some brilliant uses of this, but I can't really answer.

**Question:** Is the DOD recording and tracking that data on knowledge transference? Are you checking to see if this is working?

**Paul Jesukiewicz:** Yes, DARPA is doing this, and the data will be available to the public.