

In the Classroom 13

Using Simulations and Modeling in the Classroom

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Stan Skrabut: Thanks a lot for taking time to listen to this podcast. As I've noted over and over, you could be doing other things, but you're hanging out with me and I really appreciate it. Right now, my class on multimedia development is in week 10 and we are exploring simulations and how they can be used in the classroom. Simulations from my experience have been used a lot more outside of the classroom than in the classroom, but I think it's a very valuable tool that we should be bringing into the classroom. It allows students to navigate through life-like situations or scenarios without putting them in harm's way.

That we can look at what happens to a nuclear reactor without having a total meltdown for example. We're going to explore the idea of simulations, provide some examples of simulations and really get down to some strategies that are successful for using them in the classroom. There are far too many simulations out there to really talk about all of them and it will require going out and doing your own research for your specific discipline.

These are the things to think about, things where if students are struggling on a topic, is it possible to create this hands-on activity? The simulation that we can have them working through it to get a better understanding. Sometimes we present theory, but we don't really talk about how to apply it effectively, so this is where simulations come into play. In my experience, most of the simulations that I have been involved with have been when I was in the military, when I was in the air force, even from almost the first day we were working with simulations.

When I was going through technical school for security forces, learning how to be a security force member. At the tech school, they would have mock-up areas where we would have to guard and we would have to check badges and do a response and come in contact with the enemy and just all kinds of different things to simulate what we would be doing in our real job.

This also carried over into the real job. That as we were learning our different roles, for example, being an alarm response team member or an entry controller or alarm monitor, those different jobs., they would have simulators so we wouldn't have to do it in the real environment which could put people at risk. This allowed us to have our blank ammunition and our weapons where normally we carried real ammunition, so it was just a little safer.

That we would not have to escalate alarms to the higher levels to command posts and such. We could keep them simulated and so we could go through variety of different scenarios without putting somebody's life at risk or where it just wasn't feasible or too expensive to do this. We would have training areas where we could go in and train

that we would often walk through a scenario and then do it at more of a full speed. Then finally we would have the skills to do it in real life, so they were very useful.

In the Air Force, we had basically two different sections. We had a training section which would allow you to practice and they would provide you the tools to prepare for your evaluation, but your evaluation was really three parts. It was a written exam, it was an oral exam and then finally a practical evaluation. They would do these practical evaluations also in the simulator.

If I was a security controller responding for deploying forces and I'd have to respond to variety of scenarios anywhere from a fire with our assets to we were being attacked or a power outage or something, I would have to run checklists and I would have to call different people and I would have to get on the radio and put a variety of things in motion. To do that, they had a simulator and the simulator was just this mocked-up area where I could go through all the steps, like I would actually do it on the job so they could evaluate me. That was one example of using a simulator.

The military also use simulators in other ways. We had this piece of equipment we would attach to our weapons and it was called MILES gear which was a multiple integrated laser engagement system and basically it's like laser tech. We did this using blank ammunition and we would go through these scenarios and actually fire our weapons and engage the opposing force and these the MILES gear would go off if you happen to be in harm's way and somebody was shooting at you. That was a great way of understanding this idea between cover and concealment a lot better and how to deploy your forces and keep them safe.

We also had weapon simulations. That they started basically virtual shooting ranges where we could go in and practice with different types of weapons. Everything from our handgun to grenade launchers and do this in a virtual environment. It would save money on the amount of ammunition that we would expend, but also help provide some valuable lessons as far as engaging our targets.

One of the other areas that the military has been very good at is developing these cities where they would practice their, military operations urban terrain, MOUT. Basically how to fight in urban terrains. They would build these cities and there's places all over the nation where they have some of these areas built up where teams would go practice different things. Like running convoys or explosive ordinance disposal teams would go in and practice identify, locating and disarming IEDs, improvised explosive devices. Gaining that type of experience is invaluable.

The whole TOPGUN program for the military, if you've ever seen the movie *Top Gun*, was basically to-- They found out historically that if a fighter pilot lasted through 10 combat missions, their chance of survival significantly increased. TOPGUN was to put them in those simulations, to put them against opposing forces for 10 combat missions, to increase their survivability and that worked tremendously well.

Another program that I worked with was the Civil Air Patrol. Civil Air Patrol is a voluntary organization and has a lot of different missions working with young adults to teach them leadership. It also deals with aerospace education. Probably, the one that's

most best known is dealing with emergency services. Search lost aircraft, we help emergency managers because we fly and take photographs and we respond to emergencies that way. They do a lot of different things.

They also provide an enemy force to our Air Force that they fly slow and low airplanes and fly them into no-fly zones so that the military can use them as targets. For a jet flying hundreds of miles an hour to suddenly get down to a hundred miles an hour can be a worthwhile experience to learn about and Civil Air Patrol does that. We would have these exercises, these simulations where we were looking for a missing aircraft and we had equipment that we'd put out and signals and beacons. We would run our pilots through and our aircrews to look for these targets, but we also had what we call mission staff that would be responsible for running through the scenarios and guiding everything.

It was really an exercise where everybody got a chance to practice what they were doing and I very much consider those simulations also, but Civil Air Patrol also had other simulations. We had flight simulators, for example, that pilots would practice their skills and young adults would get in there and practice their skills and learn about aviation and how to take off and land and fly from one place to another.

They could do it very safely by changing the environment, for example. If you were used to flying in daylight and you needed to practice landing at night, with the simulator, you can practice this without putting someone in harm's way, or if you increase the weather, for example, to make it more adverse weather, you could practice flying in those conditions. That was also a very useful simulator that started back in 1910, that the first simulators came about.

Other simulators that Civil Air Patrol had is we had air traffic control simulator, that you could practice managing aircraft at different types of airports and you can increase the complexity to the number of airplanes that you had to manage to learn what it was to be an air traffic controller. Which was invaluable for young adults who were trying to figure out a career field that was related to aviation. We also had a satellite tracking kit. We could track satellites and we could simulate what it was to be in that Air Force career, for example, that did exactly that, track satellites.

Other simulators that I've been around, for example, as I work at this community college right now, there is a nursing simulation. There is a whole hospital ward with beds and mannequins and nursing equipment which allows them to practice their craft. Those different things that they can practice; that they can work on patient care, for example. There are simulators for that. They can practice the whole clinical and environments with this simulation that they've created, any of those virtual procedures. Then also electronic medical records where they can practice that.

This is all built into their simulation, which makes it very powerful giving them a leg up when they get into their career field and pass their nursing exams. They've already moved forward because they've had this opportunity to practice those things.

We also have European Union Simulation where students get to represent different countries on issues with other schools, other nations that are dealing with UN or EU

issues. That allows them to get a feel for what it is to be a diplomat or in one of those areas where they have to respond and simulate, how they would respond based on the country that they're representing, for example. Those are some of the simulations that I've personally been in or near that I could speak about.

Why use simulations? Simulations promote the use of critical and evaluative thinking. They are intentionally open-ended, they're ambiguous. You don't know what an individual is going to do or think about. You hope you have an idea, and that's why you guide it and craft it, but the individuals that are in the simulation have to work it out. They have to figure out what their response is going to be and how they are going to do it.

Simulations, they're instructional scenarios where the learner is placed in a world that the instructor, the teacher, the evaluator has created. These individuals control the parameters of the world and use it to get to a learning outcome that they want to be able to see or have learning demonstrated to them, or they are training up. They're moving the skills forward and advancing in their learning, based on working in this simulation.

It's also very much active learning. That you can't do simulations passively. That you are a player and engaging in the simulation, which makes it tremendously powerful. Having gone through probably in my career, close to 100 different simulations, you are a player. You want to get it right. You want to be successful at the end of this thing. You don't like messing up, but you learn a great deal through this failure. Simulations also, they're nonlinear in nature. The students have to make decisions, which take them down different paths. It's up to the evaluator or the instructor to respond in turn to what they're doing and guide it to the outcome that they're hoping to guide it to.

Sometimes it just doesn't work. The thing just blows up and it was a total fail. The great thing is it's very easy to reset and go through it again. Simulations have been around for a long time. As I was preparing for this, I was learning about certain simulations that were actually created in the 1600s for medical purposes. They were using training mannequins, babies, basically in order to practice different skills, but different types of simulations came on for different reasons. The military has always done tabletop simulations, for example, using the tin soldiers. That they would move soldiers around a battlefield.

That's in a way a simulation. That you can think about what's going to happen and respond to it and keep adjusting to get to the outcome you want. That's been going on for hundreds of years. The military has also used fake weapons and these exercises where they bring hundreds and hundreds of soldiers together in order to walk through maneuvers or learn how best to negotiate a building or run a convoy, or something like that. On the healthcare side, some of the earliest mannequins, the full-body mannequins came about in late 1960s and was in the field of anesthesia. It was known as Sim One and it was used for training in endotracheal intubation and induction of anesthesia.

I'm glad that somebody practiced this stuff before they got to work on me. I'd hate to be the one that this is my first time. Just learning how to put in an intubation tube is

probably pretty powerful, pretty useful. I was just watching a video or a video clip from the pararescue teams for the Air Force. They're practicing on each other. They're putting in IVs, they're putting in intubation tubes on each other. That's what they're paid for, but having these realistic mannequins or simulators, I think gives a place to start with, without putting your body into pain. That's just me. Simulations have been used for training and evaluation for a long time. Healthcare, military, law enforcement.

Almost every town has a fire department simulator where they have buildings, they light on fire or they get to hack through. Sometimes they use a real house to practice on. They'll practice cutting through roofs or lighting a fire and putting it out, but these are all simulators. They are put together in a very controlled environment. That's one of the benefits. Dealing with aviation, ever since I think 1910, they built the simulators. It was expensive to put new pilots into airplanes who did not yet know how to fly and get them out flying. What is the results of that going to be?

Those expenses, they built these simulators that they can teach a new pilot how to go through the different maneuvers before they even got into the plane. Everything from takeoff to landing and how to do that. Simulations, they certainly can be used for virtually any discipline. Coming on board, based on the use of computers and that type of technology, we now have simulators where you can practice building circuit boards, for example. Electronic circuit boards can be done virtually to get the response. That you can turn on a virtual light based on putting a circuit board together.

Stock market simulation. E-Trade, for example, I believe has a simulator where somebody new to the E-Trade program is able to practice with the simulator in order to learn how to do it, so you don't spend crazy amount of money.

The military, I've talked a lot about the military, they have simulators for aviation, for vehicles, for any type of maintenance. You have an opportunity to practice this before you do it on the real devices, saving taxpayers countless amount of money. They practice crashes. They put crews into helicopters, dump them into a pool to practice getting out of a helicopter in water situations. They have simulators for vehicle rollovers that they were using for the Humvee vehicles. They would practice how to get out of a vehicle that you're strapped in that suddenly has rolled over. Basically, a controlled simulator and they would do that.

There're aviation simulators. I remember at the bases that I was stationed at, there was a place that was a simulation center that you would go to and practice in the aircraft. One of the cool things is if you became airman of the month or airman of the quarter, or something like that, you may get a pass to go over there and sit in the simulator and fly for an hour or something. Which a lot of people, they really appreciate it.

Weather simulations, we have models and you get to learn all about weather forecasting, for example, NASA. NASA has a crazy amount of simulators. For anyone learning to spacewalk before they even go into space, they get in the pool with all their gear and practice that in that type of environment where they're floaty and they have to manipulate stuff, but they do it in a pool or for preparation for landing on Mars. We

would put astronauts into the baking deserts and have them working through those types of simulators where they live in that type of environment.

An instructional simulation, it's also considered educational simulation but it is a simulation of some type of reality, but which also includes instructional elements that help the learner explore, navigate or obtain more information about that system or environment that cannot generally be acquired for mere experimentation. The simulator really takes it to the next level.

It is goal-oriented and focuses learner on specific concepts and facts and application of whatever they're learning, whatever that environment is. It could be role-playing, which we did a lot in the Air Force. Virtual environments. This is something that's becoming more and more popular. That you have these virtual worlds that you're getting into. I'll be talking more about virtual reality, a couple of episodes from now.

Being able to work in these virtual environments, there are now gaming systems where you are 100% involved. You're carrying weapons, you're in this area where you can walk and based on your movements, it moves your character. Based on what you do, where you point, where you look, that's what you're going to see. These environments are becoming more and more realistic. The military I certainly know is using them to work through scenarios.

I worked on what was equivalent to a SWAT team when I was in the Air Force. We would do these mockups, these scenarios where we would go and enter a building that was very much like the building where the hostel was. We'd run through that a couple of times or we would just very simply go find a very big open hangar and put blue masking tape on the floor in the dimensions of the building, where the doors were, where the windows were, and enter that building and navigate through the building as a team, just to make sure that when we went through the real building, that we were doing it correctly.

There's a lot of benefits for using a simulator. Safety is probably number one. That we can keep people from getting hurt. If you're learning to use a crane, for example, there's now simulators to teach you how to use a crane before you get to the real one. Which could end up resulting in loss of life or damage to buildings or damage to the equipment, so we try to reduce that.

Accelerate the learning procedures. By having these virtual environments, you can speed up the learning to learn that environment without risk of something wrong. We've had the alarm systems. We didn't really want to work on our real systems because we didn't want to expose the things that we were protecting to the bad guys. We had simulators that we could practice unlocking a vault, for example, and we'd have that available to us.

Other thing is cost reduction. A lot cheaper to use a simulator than to use the real material. High risk, practicing emergency procedures for a nuclear reactor, probably best if you did it in a simulator, and not on the real stuff. Reduce the need for this expensive equipment. Some of the simulators I've been in are simply a bunch of plywood nailed together. We call it good, that we didn't have to have the real

equipment, but you are making it as realistic as possible. That this was a realistic environment that you could practice in or get your evaluation in.

The ability for feedback. You had somebody there over the shoulder giving you feedback as necessary as you were going through this. With these simulators, you can practice over and over and over again. This allowed you to perfect what you need to do. With the simulators, you can integrate it into your curriculum. There was one that I saw online, which I thought was pretty cool because it's--

I read through it a couple of times and it's like, "Man, that would be fun to do." Really simple simulation, but it was talking about the plague, the Black Death. Probably not something that you want to do in real life but it gave you an idea of what the odds were that you were going to get one of these major diseases and die from it. It was good to practice in those environments.

With a simulator, you can also change the difficulty level and I know this for simulators that I was in. When I was an up and coming security controller, for example, the first time you went through the simulator it was pretty basic, but the more experience you had, the more difficult they would make it. They wanted to see really how good you were. They would keep throwing scenarios and scenarios, and you had to keep track of three or four scenarios at once.

Nothing that would ever happen in real life this way, at least I hope not but you were managing all these different scenarios at one time. This allowed you to test out uncommon elements. As I mentioned, with the flight simulators, the fact that you could change from day to night, instantly. You could add adverse weather to it. These were things that you'd have to wait for a bad day or have to wait for nightfall to happen but with a simulator, you can change it right away. For the healthcare ones, you didn't have a risk to patients. That were some of the benefits.

There was a gentleman, Patrick Schuck, who wrote an article, *Simulations in Education*. He was at West Point Military Academy and he wrote this article and talked about what an instructor would need to do in order to make successful simulation or to get the most benefit out of a simulation. I wanted to share a little bit about that with you and then also some of the comments my students were making about simulations that I thought were quite intuitive to that.

One of the things that he said, "For success, educators must take into consideration the need for challenge." It has to be challenging. It can't just be so basic, that it's boring. Challenge is definitely an aspect. "There has to be guidance. You can't just let them flounder." If someone's not doing well, this has to be part of the learning opportunities. You get them on the right track so they can continue moving along.

In evaluation, you're probably going to stop but you don't want them to come back to the evaluation later and make the same mistake and fail at the same point. You want them to be able to negotiate where they're failing and be able to move forward. Then reflection is really essential. This was a piece in my course. I have a couple of folks that were in the military or are in the military and they also have to do simulators. They were in different career fields than I was in and they talked really about the importance

of this reflection piece. To sit down and debrief it and really talk about what the lessons learned were. Those things tend to stick with you.

Remember that the challenge can't be too difficult, can't be too easy. You work with each individual, make it as difficult and challenging as possible, so that you can help them grow but don't overwhelm them. You can make anyone fail, that's easy. The educators, they have to provide opportunities to be able to observe, reflect and explain what's happening in the simulation.

This is my last point. In order to help this, there really should be a guide written both for the instructor and maybe even for the student that walks through this scenario. We had to have written guides in the Air Force that we would walk through to make sure that all the points were covered adequately for this. That's a little bit about simulations.

Honestly, I thought this was going to go a little shorter, but there's a lot to the simulations. I just don't think we're doing enough in Higher Ed with simulations. I think they're really a powerful tool. Naturally, you can read more about it. Speaking about reading, I'm a fan of my book *Read to Succeed*, so here's a quick plug for my book.