Transcript: 30 Brave Minutes Episode 59

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00:06.5 Speaker: Dr. Richard Gay

Welcome to 30 Brave Minutes, a podcast at the College of Arts and Sciences at the University of North Carolina at Pembroke. In 30 Brave Minutes, we'll give you something interesting to think about. I'm Richard Gay, Dean of the College and joining me are Dr. Ashley Allen and Dr. Joanna Hersey, along with Dr. Stephen Singletary from the Department of Chemistry and Physics. Now get ready for 30 Brave Minutes.

Hey, Steven, tell us something about yourself.

00:32.5 Speaker Dr. Stephen Singletary

I'm a native of the area, did my undergraduate degree here at UNC Pembroke, so I feel a very personal connection to this place. And so, anything I can do to help the students and help the surrounding community, I'm all in for. Let's talk about that.

00:51.5 Speaker Dr. Richard Gay

Excellent. Well, I think we should brag a little bit about your degree is from MIT. So, I think it's wonderful that we have such wonderful success stories of our students like yourself, who get their start here in the community and then come back and try to give back to the community. So, kudos to you and others like you who are contributing like this. So, thank you so much.

Speaker Dr. Stephen Singletary

Thank you.

Speaker Dr. Richard Gay

Now, today's topic is 3D printing. So how did you get interested in 3D printing?

01:20.7 Speaker Dr. Stephen Singletary

I've always been interested in making stuff and building stuff. Growing up, I was always building models. My room was full of the model airplanes, model ships, and so when 3D printing came about and I first heard about it, I'm like, oh, this is wonderful, I need to get one of these. So, I bought one of the first printers that was commercially available and have just been building and creating ever since.

01:43.2 Speaker Dr. Richard Gay

So, for those of us who are not familiar with this technology, could you give us a quick run-through about how a 3D printer works?

01:50.0 Speaker 2 Dr. Stephen Singletary

So, a 3D printer will basically take anything that you have in your head and can put it in your hand. And we kind of have to go through the computer first. So, you get your idea into a computer program that the printer can understand. And just like a normal printer you have in your office that will print a sheet of paper with text on it, this will print an object in three dimensions. The early ones were all out of plastic, but now everyone is working on these and we can print things out of stainless steel, copper, nylon, glow-in-the-dark material, food-grade materials, conductive materials, insulating materials. So, we're getting to the point where we can print just about anything.

02:39.0 Speaker 1 Dr. Richard Gay

Even human cells, I understand.

02:42.2 Speaker 2 Dr. Stephen Singletary

Actually, one of the first printers was designed to print a human kidney.

02:47.9 Speaker 3 Dr. Ashley Allen

Tell us a little bit about 3D printing and our students' exposure to it at UNCP. What do they take classes? How do they engage with 3D printers?

02:59.7 Speaker 2 Dr. Stephen Singletary

So, we don't really have anything formal in the curriculum yet. We're working on that. So far, we've been offering seminars and workshops for the students. And it turns out we have quite a few printers across campus, but they haven't really been formally or brought together to expose students to. And so, it's kind of ad hoc the way they've been introduced to it. Some students may have gotten interested in it and branched out on their own and decided to buy a printer and try to figure out how it works. And I get a lot of them coming to my office frustrated, like, how do I make this thing work? And then a lot of them have seen stories on the Internet, like the swim meet story we'll talk about later, and they want to know more, and they'll stop by and ask questions. And so, what I'm hoping is we can get a little bit more formalized with how we're introducing students that way. One thing I've learned is that will let us reach more students and get them printing faster, which is all they want. They just want to be printing stuff.

04:06.1 Speaker 3 Dr. Ashley Allen

I completely agree. And as you're well aware, my teenager now has a 3D printer, which I emailed Steven about a ton because I had questions about what kind to get for her. And also, I think I put it together wrong. He needed to help me sort through that. But one of the things that I have been short on guidance is just, she has a 3D printer. She's managed to do some very small things, but she's just trying to figure out where does she go for information of how to really practice, if that makes sense.

04:45.8 Speaker 2 Dr. Stephen Singletary

Yeah. And when I do the intro workshops for 3D printing, I actually take people through the history of 3D printing because it's interesting. People think it's new technology. The first printers were actually developed back in the early 80s, but they were patented right off the bat, and patents are good for 20

years. And so, the first players were really big companies, there are three big companies that had the technology locked up. The patents expired around 2003. And then in 2005, there was something called the Rep Wrap Project, which developed open-source 3D printing. And that's when 3D printing really took off. But we're still kind of in the Wild West phase of this. There are many different companies, many different printers that are out there, different printing softwares that are out there. So, I think instead of really teaching people about 3D printing right now, sometimes it's more like acting as a guide through the wilderness, as it were. Here are the printers that are easy to use. Here are the printers that are temperamental. Here are the softwares that are easy to use. Here are the softwares that have a lot of functionality, but the learning curve is kind of steep. So that's what a lot of my interactions with people about 3D printing are sort of centered on right now.

06:07.1 Speaker 3 Dr. Ashley Allen

Will you speak a little bit about the camps that you've done over the summer? Because those are younger students. And what does that look like? Trying to teach 3D printing to, I think, what's the youngest age you've worked with?

06:22.5 Speaker 2 Dr. Stephen Singletary

So, the 3D printing camps that we've been running during the summer through our Office of Regional Engagement?

Speaker 3 Dr. Ashley Allen

Office of Regional Initiatives.

06:31 Speaker 2 Dr. Stephen Singletary

Initiatives, yes. They run all types of camps to impact people in the community or reach out to people in the community. And so, we've started offering our 3D printing camps through them so that we reach more than just our students and our faculty. The camps are normally one week long, and the youngest that I've had in there so far has been twelve years of age. And she took to it like a fish to water. The younger generation is really comfortable with technology. And so, the computer part, I have no problem getting them into the software and taking the ideas from their head and putting them into the computer. A lot of times they have more trouble when it comes to the hands-on part, like, okay, the printer is not printing what you wanted. Now we have to get into the nuts and bolts and figure out what's going on. And so, the younger kids, they're really great with this. They're pulling all kinds of things that they want to print. Well, like you were saying sometimes like your daughter was wondering about what do I print? These kids have no problem coming up with stuff to print. There were whistles. One of the kids wanted the 3D print a movie, prop knife, a lot of stuff from the Avengers. Dungeons and Dragons is still a thing. I'm finding out everybody who comes to the 3D printing seminar wants to print Dungeons and Dragons figures. It's amazing. Yeah. Anyway, so the last camp that we ran, I had as young as twelve and as old as eighteen in the camp.

08:02.6 Speaker 3 Dr. Ashley Allen

Wow. So, this is just a technical question. You know how it's hard sometimes to get the 3D printing material to stick? What's your best solution for that?

08:11.0 Speaker 2 Dr. Stephen Singletary

Glue.

08:12.0 Speaker 3 Dr. Ashley Allen

Really?

08:13.0 **Speaker 2 Dr. Stephen Singletary**

Glue? Yes.

08:14 Speaker 3 Dr. Ashley Allen

A glue stick?

08:15.0---- Speaker 2 Dr. Stephen Singletary

Yes. So, some of the printers actually come with glue sticks. Some of the printers, like the Ender 3, they have the mats that go onto the print bed that have a rough surface on it, that's supposed to be able to hold onto the filament as it's being extruded. But a lot of times I just take a glue stick and rub it over real quick. You have to be careful though, in some of the bigger, more advanced printers. They will tell you for this material, only one layer of glue. Some materials need two layers of glue. I've tested that to see if the manual is right. And the manual was right. Yeah, simple glue.

08:56.1 Speaker 4 Dr. Joanna Hersey

And I feel like I'm realizing for the first time, maybe that the problem-solving aspect of this initiative with our students. I think I thought of it as maybe engineering and again, physics and a fun thing that we do with students at a summer camp. But this problem-solving aspect, how do you walk students through again, young as twelve, or our students at UNCP, this aspect of really learning this wilderness, as you called it, together, what are some stumbling blocks and how do you work them through that?

09:26.2 Speaker 2 Dr. Stephen Singletary

That's actually a good point, because at the beginning of each of these camps, I tell everyone the same thing, no matter their age. In ten minutes, I can have you printing something, and as long as the printer is working like it's supposed to, everything is fine. The problems come when the printer is not working like it's supposed to and that can be a semester's worth of instruction and trying to figure out what's going on. And so, the way I get around it is I take everyone through the basics of 3D printing, like take the printer itself out, here's the theory behind the thing works. Here are the commonalities you should see between all of the printers, and then we start talking about, all right, if you see this on a printer, what does this tell you is going on? And so, it really gets down to everything from looking at the shape of the filament that's being extruded. Is it being put in the right place? So that could mean everything from the temperature of your print head is wrong, to maybe the belts on your motors are slipping, to maybe your file that you sent to the printer wasn't fixed just quite right, because there's several different steps you have to go through to get from what's in your mind to what's on the build plate.

10:44.8 Speaker 3 Dr. Ashley Allen

Steven, can you speak a little bit about 3D printing of houses?

10:50.5 Speaker 2 Dr. Stephen Singletary

This is something I wish, I want to see one of these. I want to get one of these here, because 3D printers, there's really no limit on their size. So, the ones that are 3D printing houses now, they look just like the small 3D printers you can buy from Amazon, but they're literally house-size. And instead of using plastic, it's using concrete. And so, anything that you run through the printer, essentially the base characteristic of the material is that at some point it has to flow and then it has to harden after you put it where you want it. And so, with plastic, that's why we have to heat it up because everyone knows when you melt plastic, you get this nice stretchy stuff, and when it cools, it hardens in place. And so concrete fits those criteria before it sets up, it flows really easily. We can move it to where we want it. You let it sit there for a little bit and you get this nice hard material. And so, printers have been developed that as long as you keep pouring concrete into the feed chute, you can keep moving the nozzle around and 3D print a structure. There was actually a house, the first house, a 3D printed house, sold in New York a couple of years ago. NASA is currently building these types of 3D printers to send to the moon and to the Mars ahead of the astronauts to build structures before we get there. So, like I said before, what a 3D printer can do is right now basically limited by the imagination of the user at this point.

12:24.3 Speaker 1 Dr. Richard Gay

Could you talk us through a little bit of the components of a 3D printer? You guys have inspired me. I'm sitting here thinking, I wonder where I could put a 3D printer and what I could do with it. I've been using my cell phone, the LiDAR function on my cell phone to capture 3D images that I can rotate and spin and the like. And my suspicion is that I could print those. So, if I were looking for a printer, what should I be looking for?

12:50.1 Speaker 2 Dr. Stephen Singletary

I would say the biggest thing, and this is what I tell all the students who take the seminars in the workshop, is look for ease of use. And at this point 3D printing has been out in the public for about 20 years. We're coming up on 20 years. And so, we've started to go through that process where we're narrowing down to two or three companies that are in the lead in terms of how easy it is to use their product. There's still a whole bunch of printers out there. Some of them are a little bit more temperamental than others. But any of the printers that are currently on the market should be able to be unboxed and used by anyone with very little 3D print. The basics behind all of it is what we call layer by layer. So, any 3D printer let me amend that. I'll come back to that in a second. Currently, all these 3D printers go layer by layer. So, you have to put down a full, complete layer. You move up a layer, put down your next one, move up, put down your next one. And so, any 3D printer that we have right now will have at least three motors. One to move your nozzle in two dimensions, and then into the third dimension to put your stuff down, and then some type of feed mechanism to move your material that you're building out of. Now, there are another class of printers, they're called resin printers, where we've taken it now to where we only have one motor. These are a little bit more advanced, but the detail that we can get on our objects is just amazing. And let me grab something really quick just to show

you the detail that we can get. I don't know if you can see this or not, but this was printed on one of our resin printers. It's a model of the Eiffel Tower, but you can see all of the individual girders that were printed in there. And essentially what we're doing now is we're again using material that will easily move, but some process to harden it in place. And so, these use a resin that we will use ultraviolet light, or we use UV lasers to freeze it. It is the same stuff that they make dental appliances out of. And so now we'll use an LCD screen that we can use as a mask. We'll unmask our layer, shine the laser, harden it, pull it up a little bit, unmask, harden a little layer, pull it up. And so, it's still layer by layer, but all kinds of different technologies to get that done. And the exciting part right now, the one that I wanted to come back to is there's a new company based in Italy that we've been talking with. They've actually put the print head instead of using the three motors to move it in three dimensions, they put it on the end of a robotic arm. And so now, instead of printing layer by layer, they can print any type of complex shape. And we're talking with them now about possibly putting one here that they need some help reprogramming some of the robotic arms. And so, keep your fingers crossed. Maybe that'll be a development her coming soon.

15:58.2 *Advertisement* Speaker: Dr. Robin Cummings

This is Chancellor Robin Cummings and I want to thank you for listening to 30 Brave Minutes. Our faculty and students provide expertise, energy, and passion driving our region forward. Our commitment to southeastern North Carolina has never been stronger through our teaching, our research, and our community outreach. I want to encourage you to consider making a tax-deductible contribution to the College of Arts and Sciences at the University of North Carolina at Pembroke. With your help, we will continue our impact for generations to come. You can donate online at www.uncp.edu/give Thanks again for listening. Now back to more 30 Brave Minutes.

16:39.8 Speaker 1 Dr. Richard Gay

It really does seem like the possibilities are endless here.

16:42.6 Speaker 2 Dr. Stephen Singletary

Yeah, sorry, that was kind of a rambling answer to your question, but when I get on 3D printers, it just it's like free-formed thought.

16:50.2 Speaker 1 Dr. Richard Gay

Well, I appreciate it because the idea of them having three motors, I would not have thought of that. I'm not a mechanic. My mind doesn't think in mechanical terms. So just learning that they have three motors is interesting to me and hopefully to our listeners as well.

17:03.3 Speaker 2 Dr. Stephen Singletary

Now, I will say one of the things that I'll do every so often is I take our large 3D printer and I'll roll it out into our sort of welcome area right by the elevator where the department office is at, and I'll just start it printing. So, for example, at Halloween, I had it print pumpkins. At Thanksgiving we printed turkeys. And then we would print Christmas decorations or Christmas theme items. And I would always put out a stack of cards of my business cards there, and I had to keep refilling them. Every day I would walk by and there would be students talking about what was going on. I would see faculty group together talking

about what was going on, faculty and students talking about what was going on. So, it was one of those things that spur conversation, and that's always a good thing.

17:47.9 Speaker 1 Dr. Richard Gay

Absolutely. And I'm excited about the course you're developing where students may learn to use CAD and then translate that into 3D objects as well. So, I think there's some really great possibilities here and how this can develop. Those are important skills to have.

18:06 Speaker 2 Dr. Stephen Singletary

Absolutely. One of the reasons that we're trying to get that through is now, if you want to get into any of the engineering fields, it's becoming one of those necessary skills. It's not so much written in the job descriptions yet, but I've heard a lot of students come back, and the first thing that their interviewers will ask is do you know how to 3D print? And a couple of our former students have said, yes, I know how to 3D print. And now they're working as engineers. I don't know if that's enough for a correlation yet or not, but it's enough for me.

18:39.3 Speaker 4 Dr. Joanna Hersey

Can you tell us about some of the favorite projects that the students have done recently?

18:43.4 Speaker 2 Dr. Stephen Singletary

Well, for me, the big thing is our rocket team this year, the team that's going to Wisconsin for the First Nations launch competition, they had to build a rocket completely from scratch. Had to be based on a kit and a lot of the internal components, they are 3D printing. And it's not just that they're 3D printing them. They had to design these parts themselves in the CAD program. They had to go through all the calculations just like you would if you were working at SpaceX or NASA to make sure that these things aren't going to fail in flight. And they're assembling the rocket right now. And hopefully, in a couple of weeks, we're going to go test out their 3D printed materials and see if they work. Hopefully, we know before we go to the competition.

19:31.0 Speaker 1 Dr. Richard Gay

You've had success in the past, so I have all the confidence in the world in you and the team. I understand that team is getting larger. Right? There seems to be a lot of development in that area.

19:40.3 Speaker 2 Dr. Stephen Singletary

Yeah, we've got enough we're running two competition teams this year. We're sending one team to NASA's Marshall Space Flight Center for the Undergraduate Student Launch Initiative, and then another team to Wisconsin for NASA's First Nations Launch Competition.

19:54.3 Speaker 1 Dr. Richard Gay

Excellent. I know you'll do us proud.

19:56.5 Speaker 4 Dr. Joanna Hersey

Now, Steven, I know that in my area people are 3D printing things like tuba mouthpieces and musical components. Have we had any students do anything with that yet?

20:07.2 Speaker 2 Dr. Stephen Singletary

Music? No. But I have had a couple of theater majors come over and sit through the seminar and workshops. And I know there have been several props that have been printed that showed up in some productions. Not exactly sure what the props were or which productions they were, but I know the students were really excited about it. I have had a few students come over from the Art Department that wanted to learn more about 3D printing. And that's leading us to this new collaboration with the course that Dr. Gay talked about a few minutes ago, where we're hoping to either team teach or cross-list it with the Art Department. I talked with them earlier this week, and I'm excited about that now about all the stuff that we're going to be able to do.

20:48.6 Speaker 1 Dr. Richard Gay

It would be wonderful if we could set up a demo. Your demos outside your office are great, but it would be nice to maybe set one up in a more public place. I'm sure you could get lots of interest in this course when it comes along.

21:03.0 Speaker 2 Dr. Stephen Singletary

That's one of the things I'm actually kind of worried about, is when word gets out and we've got it set at 20 seats, how many sections are we going to end up having to offer? But it's a good problem to have. Really good problem to have. But if you want a tuba mouthpiece printed right now, I can print in stainless steel. So, feel free to send one over and I'll see.

21:24.1 Speaker 4 Dr. Joanna Hersey

That sounds great. We could stamp UNCP right on the side of the thing.

21:30.2 Speaker 2 Dr. Stephen Singletary

Absolutely. Absolutely.

21:32.0 Speaker 1 Dr. Richard Gay

So, Stephen, would you mind? That fascinates me. You can print in stainless steel. So, can you give us an idea of the materials that we can print with here on campus? Stainless steel sounds pretty complicated.

21:43.5 Speaker 2 Dr. Stephen Singletary

So right now, we have the sort of base material everyone prints with, or everyone learns to print with us, called PLA. It's a basic plastic. All of the base-level printers you buy from Amazon will print in PLA. So obviously we can print PLA. We can print with nylon, which we've actually used to print several things that we've used in the lab because nylon we can etch with acid and then do things in the chemistry lab, like functionalize and attach different molecules to it so we can do different experiments. We can print with ABS, which is if you've seen the black pipes they use in plumbing, the heavy-duty black pipes, we

can print in that material. Our big printer, the one that I wheel out in front of the elevator, can print, I think it's about 80 different materials that have been certified on it. But there are variations on those different filaments. Some of the filaments, you can get wood fibers put in them, so it looks like you have a wooden piece. You can get marble. You can have marble chips in it, you can have copper in it, different types of metals. So that your printed piece, you can print what looks like a bronze bust or a marble statue. It's still plastic. It feels like plastic, but before you touch it, it really does look like it's one of those other materials. Carbon fiber…we do have a resin printer. That one's exciting because the different types of resins that you can get, so you can get resins that are bio-mimicking. And what I mean by that is we actually had a student several semesters ago, he had a stray cat that he had adopted that was missing its front forelimb. He 3D printed a prosthetic for the cat. Now, if you did that out of just basic plastic, that's a hard, rigid piece that you're always walking on. But with the biomimicking resin, it actually has some give to it so that when you step on it, it sort of absorbs the impact. You can get resins that have ceramic powders in them so that after you cure it, you can basically print a ceramic coffee cup. The newest printer we've got can print in two different materials at once. And so, we have a lot of times when you print based on the shape of your object, you have to print supports. So, imagine if you were trying to print a T that was standing up. You can't print the top of the T out in space. The material is going to fall. So, the slicing program, one of those steps we go through, has to print a support under it to hold it up. So now we have a printer that will print those supports in a separate water-dissolving material. So now, instead of spending so much time having to cut all the supports off, we just go put it in a bowl of water, come back, and our part is all nice and ready to go. The range of materials is growing every day. So far, we can do a lot here on campus now.

24:41.6 Speaker 1 Dr. Richard Gay

I find that fascinating, all the different options there. And for the creative types, I can see that they would really enjoy this. And one of the parts that I'm so excited about, as you've alluded to earlier, is the engineering applications. Right? We have a nice 3+2 program where students can get degrees here at UNCP and Applied Physics and then move on to N.C State for their degree in engineering. And it seems like they're learning some really valuable skills out of your work there.

25:17.3 Speaker 2 Dr. Stephen Singletary

Yeah, I completely agree. And it's not just the 3D printing aspect of it. The engineering students are also learning those steps prior to the print, which involves the computer-aided drafting and design that's huge, that’s always been big in the engineering field. But now this gives them something that it makes it a little bit more fun, because now they can go print. It's not just some, oh, now we got to go sit on the computer and draw this stuff, and we don't see why we're doing it. Well, now you see exactly why you're doing it. It's helping them learn those skills, especially as Dr. Hersey alluded to earlier, the problem-solving. That's always something that we're looking for in the engineering field. And this, in addition to learning how to print, is giving them that mini course. And, okay, here's the problem. How do we solve it with what we got?

26:07.4 Speaker 1 Dr. Richard Gay

And the part that I find so exciting about it is that it's really a great way to bridge the gap between the theoretical intellectual properties of the classroom with practical applications in industry or everyday

life, for that matter. So, it really is a nice medium to bridge that gap, which is, I think many disciplines do struggle to define those practical applications. And it's nice to have such a clear example here.

26:37.0 Speaker 2 Dr. Stephen Singletary

Absolutely. And what I'm finding now is also helping us bridge the gap between disciplines, because now we've got this collaboration with the Art department, and we had this collaboration with Athletics. So, 3D printing is turning into one of these things, it’s bringing everybody together.

26:56.3 Speaker 1 Dr. Richard Gay

Excellent, excellent. I love hearing that. Now, you mentioned Athletics, so you mentioned a swim meet earlier. Can you tell us a bit about that experience?

27:04.9 Speaker 2 Dr. Stephen Singletary

So, this is where several semesters ago, the university photographer came over, and I told him we were running a 3D printing course, and he came over and took pictures and got interested in what we were doing and talked with the students. And then a couple of weeks ago, he said, hey, can you print so and so? Yeah, I can print so and so. That's not a problem. What do you need? And then he started telling me about an issue that the swim coach had run into. One of the plastic brackets on one of their swim podiums that they used to hold starting blocks had broken. Why didn't you call the company? He said he did call the company. They don't make it anymore. And so, it was either they had to find money to go replace all of the blocks because all of the blocks had to be identical for fairness, or he said they may have to cancel the meet. Okay. So, I went over, got one of the parts, brought it back, went through the whole process of putting it into the computer and running it through the printer. Took it back over, it fit, and the meet went off without a hitch. The only problem was one of the blocks was a different color because I couldn't match their color right off. But I told him over the summer, we're going to print him an entire set for all of the starting blocks, where one side is gold, one side is black, so they'll be the only location that will have school color starting blocks.

28:35.6 Speaker 1 Dr. Richard Gay

Excellent. Perfect example of that practical application, right?

28:39.1 Speaker 2 Dr. Stephen Singletary

Right. And it reminds me that I really need to get out of the building and out of the silo a little bit more so that people know what we have over here. I'm sure there are more places that we could use this technology to help out around campus.

28:58.4 Speaker 3 Dr. Ashley Allen

Well, I know we talked about 3D printing houses, but where do you see 3D printing moving in the future? What's the next step?

29:08.6 Speaker 2 Dr. Stephen Singletary

That's a question I get quite often, and I don't think it's happened yet. But where I see this potentially going in the future is the combination of 3D printing with artificial intelligence. It gets kind of scary at

that point because you can imagine if we've got a really advanced AI and it decides, hey, I need some legs, and then it 3D prints itself some legs, that could be an issue. I think we're getting to a point to where 3D printers will join the internet of things at some point. So, we've got smart houses, we've got smart cars, we've got all of this other stuff. If you add a 3D printer into that, you could imagine a scenario where let's say your smart car, you're in it and you're on the way home, and a part breaks and it communicates with the printer in your smart home, and says, hey, this part broke, we need a new one. By the time you get home, your new part is all ready to be installed. So potentially at a point where systems are repairing themselves on the fly, I don't think we're near that yet, but I think we have all the pieces in place where something like that could be developed. So, I would say in 20 to 30 years, I would not be surprised to see some types of systems like that.

30:26.4 Speaker 3 Dr. Ashley Allen

That is both fascinating and scary.

30:29.9 Speaker 2 Dr. Stephen Singletary

Yes, it is, but it always leads to some good discussions because especially with our students, they start coming up, well, these what if scenarios, do you think it could do this? Yeah, anything is possible.

30:43.3 Speaker 1 Dr. Richard Gay

But back to these practical applications. I could really imagine the scenario that you just mentioned about a car that could apply to anything, say, that I needed to replace, I don't know, a washer in my faucet. I could print it at home.

30:57.7 Speaker 2 Dr. Stephen Singletary

And I think there's even more applications as we get better with the printers, because we have 3D printers now that will 3D print food. You can 3D print pizzas. There's actually a restaurant in the Netherlands where everything on the menu is 3D printed. I've never tried it. I don't know anything about the taste. It looks fantastic, but I'm not sure how it would taste. But one of the things that I've always told my students, I think would be if we could ever develop this, it could be a game changer. But we have copy machines now where you go put in your paper and you copy it, and you get as many copies as you need. Well, now, some of the 3D printers that are coming out, they're completely enclosed, and they combine a 3D scanner with a 3D printer. So, for example, I can take my little object here that I showed you. I can put that into the scanner, hit scan, take it out, and it'll print a copy. So now we have a copy machine in three dimensions. I keep telling my students, wouldn't it be awesome if we could do that with a ham sandwich? Let's go put the ham sandwich on the copier and just make copies of it. Think about every day how many stories we hear about food insecurity or people that are in famine. We could send them one of these printers that could just print the food. Of course, we'd have to have the material to go into it. But I know we said things can get dark, but there's also a lot of potential for good here as well.

32:26.5 Speaker 1 Dr. Richard Gay

I keep seeing a Star Trek replicator.

32:29.2 Speaker 2 Dr. Stephen Singletary

And that's – unfortunately, do you know how many of our students have never watched Star Trek? This comes up in every one of my classes every semester, because I'm always referring back to it, and they look at me like I'm speaking Klingon, never watched it, don't know what it is. It's disheartening.

32:49.4 Speaker 1 Dr. Richard Gay

It is. You'll have to show them a clip.

32:51.9 Speaker 2 Dr. Stephen Singletary

Yeah, you're right. The replicator is exactly what I think of when I see the printers that are combining the scanner and the printing capabilities. It's essentially what it is.

33:01.8 Speaker 1 Dr. Richard Gay

Well, Steven, I've really enjoyed our conversation today. I feel like I've learned a lot. I certainly learned a lot about the possibilities of 3D printing. And you've really inspired me to think about this more in the future, which is one of the great things about having conversations with great faculty like you. So, thank you so much for being that inspiration for our listeners today, and hopefully, we can have you back again and you can tell us more about the success of the Rocket Team. I'd like to learn more about that.

33:30 Speaker 2 Dr. Stephen Singletary

Sure thing. Thank you for having me on.

33:35.0 Closing Credits

This podcast was edited and transcribed by Joanna Hersey, and our theme music was composed by Riley Morton. Thanks for listening and Go Braves.