Online STEM practical experience using the OpenSTEM Labs

KAREN FOLEY: Welcome back to the Student Help Live STEM Induction and Freshers Event. Now who is doing some practical stuff? Who is going to be using the OpenSTEM labs? You may not know yet whether you are or not, but some of you may have questions about this. But we're going to get a brief preview of what it's all about with James Smith, who is a senior manager for the Open University STEM labs, the online platform through which The Open University's science and engineering practical activities and experiences are delivered.

Now James oversees the developments of these and also the use of the OpenSTEM labs in OU modules, these activities, and coordinates effects that give STEM students a very authentic experience at a distance. So this is very, very exciting.

So, James, welcome to the show. Can I start by asking you to give us a little bit of an overview about what the Open labs are?

JAMES SMITH: Sure. Hi, Karen. Well, at the OU, we've always had to come up with an innovative solution to sort of give our STEM students that sort of authentic practical experience. Now in the old days, a lot of students would go to residential schools, and they'd get a very sort of compressed, practical experience over the course of a weekend or week.

We even used to send out some home experiment kits, so we used to send out instruments and samples in the post. And there are lots of implications now of why that's not perhaps a very good idea these days. But with the advent of the internet, we started to think about, well, how could we give our students sort of a practical experience over the internet to their screens, to their computer screens, because a lot of science and engineering is now done sort of via a computer screen. A lot of instruments are controlled sort of via computer screen, so the OpenSTEM labs is really the culmination of our efforts over the last 20 years to give students an online, real and authentic practical experience.

KAREN FOLEY: One of the things I love about the OpenSTEM labs and that I've heard from so many colleagues is that it isn't a lesser equivalent of something that will be better always to do at a face-to-face university. In some cases, there are equivalents that need to be done online because our students are learning at a distance, but in many, many cases, often what you're offering students is something far superior. We'll talk a little bit later, but for example, access to observatories and things that students at a typical university would never be able to get hold of operating a telescope, which is very, very expensive indeed.

So how … what's the sort of structure then of the OpenSTEM How might they sort of look in terms of how students study? You've got a diagram that sort of shows how it all links together.

JAMES SMITH: Sure. So the OpenSTEM labs itself is kind of an umbrella organisation around a number of sort of sub-labs really. So if you're a science student, then you would access what we call the Open science laboratory, and in there, you would have a range of activities. Some of them sort of on-screen interactive types. Some of them are sort of

connections to real pieces of equipment, and some of them are working on real pieces of data that have been taken elsewhere and packaged up for you to work on in an authentic manner.

If you're an astronomy student, then … I mean, we talk a little bit more about this later, but over the course of your studies, you will be able to use our telescopes internally remotely from your own home via your laptop or your tablet. Engineering students, we have something called an Open engineering laboratory, and in there, currently, you will get a real connection to some real pieces of engineering equipment. And we also still retain an ability to sort of bring people to a place, which is quite difficult at the moment, and there are various solutions going on to that. So we still bring people together for residential experiences or face-to-face activity where there's a particular need. So that may be in sort of chemistry where people were coming to learn chemistry techniques, which are still best done in the lab, or in, for example, geology, where field trips are still a very important part of the learning process.

KAREN FOLEY: Brilliant. That's wonderful. Now some students … well, students will be pointed at these, won't they? So students who need to access certain things, it will be very clear about where and when they go because their modules are all structured in a really nice way so that their study calendar will tell them, for example, what they need to do and when. But when they do need to access the OpenSTEM labs, what does it look like, and how do students actually go and access it?

JAMES SMITH: So typically, there will be a link in your module materials, which will take you to a particular experiment. What we're seeing at the moment, or what we can see, is a picture of our front page. The links from module activities tend to bypass that and go direct to the experiment that you are being asked to carry out at that particular time.

So it's all sort of seamless really. There's a seamless experience. For experiments that you can just do then and there so to speak, you will be able to launch the experiment and do that. If it's a remote piece of kit that you need to use, then you may need to book a slot. But we have a seamless booking system, so you will book a slot on a piece of kit. And then you will come back to that page one day later or a week later to carry out your session.

KAREN FOLEY: That's absolutely brilliant because there are, on campus, virtual … well, real things that people can access virtually, so you get a time slot when you can actually operate that device virtually. It's super exciting. Vic, are people at home looking forward to this? Have we heard from students who've maybe use the OpenSTEM labs?

VICTORIA PEARSON: Both of those things, yeah. So we've got … Beverly says she loves the Open labs, which is brilliant news. We have some people that are excited about the potential of using the maths facility, which is really good news. And we have a question … maybe this is for James … from Nigel, which is the one thing he wonders about is what might be missing is the messy business of setting up the equipment to do the experiment. Can you say something about how that works from your end?

JAMES SMITH: Yeah, so, essentially, we take care of that, but there's … in some areas, there is a need to prepare samples or calibrate the equipment. And that's an area that it's something we're looking at quite closely how we can sort of, if you like, extend the actual use of a kit out to sort of knowing and understanding a bit more about the piece of equipment you're using or the technique that you're using. But typically, where we can't give that experience, in your module materials, you will find sort of guidance on what would be done.

So you may see sort of a video, which tells you how to prepare a sample, and you may still get questioned on that in your assignments. So it's still things that you need to know, but we're looking more closely at how we can sort of try and bring a bit more along in the pre-lab area of sample prep and understanding more about equipment.

KAREN FOLEY: Brilliant. Eliza says she really likes the experiment. She had to blow a fuse once, which, she said, was very fun. So tell us then, James, about what sorts of experiments there are in the OpenSTEM labs. What sorts of things are lined up for students?

JAMES SMITH: So one particular set that we have, as we spoke about, is our remote experiments, and these are where a student or group of students will book a slot to use a particular piece of equipment. And that may well be a scanning electron microscope, so we have electron microscopes on our campus in Walton Hall that students will be able to log into pretty much 24 hours a day, seven days a week, and control. So what we see here on the screen here is a shot of our remote electron microscope interface. And I am not a biologist, but that looks suspiciously like a fruit fly eye to me there.

So in the top left of that image, you can see the sample tray, so you can see we can put many samples in this electron microscope. And then you can sort of move around and select which sample you need to look up. But, again, in your module materials, you will be told which sample that you need to analyse, and there's a bit more of a close up view there of the eye.

On campus, we have a variety of other remote experiments. We have a radio dish, which we can perform radio astronomy with. So students, in this case, log onto it in sort of groups of three or four, and they talk together while they're using it. They moved the dish. They take their measurements, and then they go away, and they analyse them together in a group, so that's a really good group work activity.

And there's a whole range of other experiments that we have that … not necessarily remote experiments, but more of what we call on-screen interactives. So, typically, you would do them on your own. You would sort of have an interface where you would need to perform measurements. So what we're looking at now is a skull measurement activity so comparing different types of skulls and their evolutionary history. And this particular one is used at Level 1, in the Level 1 science modules. So there's a whole range of experiments that we need to use, that we use, and it gives that breadth of practical experience across a whole range of STEM subjects.

KAREN FOLEY: James says he had a whole beaker of stuff spilled down him at school, so he's very grateful that we're going to be doing this all online. [LAUGHS]

So can we take a little video as well to show people a little bit about these experiences, James?

JAMES SMITH: Sure. Yeah, so we mentioned our telescopes in Tenerife, and here they are. And those of you who have been to Tenerife will maybe recognise Mount Teide. So our telescopes are at an observatory just off the side of that. These are used every night, really, for student use in modules.

They're used for research. We have people looking at time variable stars and also near-Earth asteroids as well. And we also use these telescopes in an outreach capacity, so for those of

you who are interested, at the moment, we have available via the OpenLearn platform what we call a badged Open course, where you can gain a chance to use the telescopes yourself.

We're just looking here, again, at another usage of the electron microscope that was. This is an engineering experiment, pendulums, where students learn about sort of control. So students are actually making that pendulum dangle and taking those measurements from wherever they are. And here's an example of our on-screen … what we call on-screen experiments. So this particular experiment is to do with the use of a spirometer, which is a typical sort of medical instrument that may be used, and here, we're teaching students about sort of what results that can produce.

KAREN FOLEY: Brilliant. That's wonderful. Vic, I hear there's some interest in the badged Open course.

VICTORIA PEARSON: That's actually the one that James has just mentioned. There's a few people now quite keen to do it. Stephanie says she is still doing it now, so that's good news. Well advertised there, James.

Just to pick up on one thing from Nigel, he's suggested that his brother-in-law, who is an OU science graduate, actually uses telescopes remotely for his research. So it's not really far off, James, is it, reality that the telescopes that are in OpenSTEM and what researchers actually use?

JAMES SMITH: Absolutely. I mean, I, myself, am an astronomer sort of by training and sort of when I was doing my PhD. In the early stages of research, we used to go to the telescopes and use them. Now the positive of that is that telescopes are usually in exotic places like Hawaii and the Canary Islands. Nowadays, pretty much everything can be done remotely, so professional astronomers use a lot of the telescopes remotely in a way that's very, very similar to how our OU students … we use our telescopes. So in that particular subject area, we really are giving you that sort of professional experience that you might undertake yourself if you went on to study further or partake in research.

KAREN FOLEY: And then other news, James, there's some confusion over phrenology and craniology. Although, everyone says it is just skulls at the end of the day. Could you clarify any of that?

JAMES SMITH: As I said, I'm an astronomer by training, so I think that's outside of my sort of particular skill set.

KAREN FOLEY: Oh, no, that's absolutely fine. There's so many different areas of interest at The Open University. I'm sure somebody somewhere deep in a cupboard in K Block knows something about that. Excellent.

So people are saying they're up for it, and some people are even wanting to leave this show to get on with things. What sorts of things can students who may not have these activities embedded in their module materials do? So people who are just interested outside the formal curriculum, what can they do to have a bit of fun with the OpenSTEM labs?

JAMES SMITH: Sure. So our main website is www.opensciencelab.ac.uk, and there's a link to that on the student hub live page as there is a link to the badged Open course for

astronomy. And if you go to that link, you will be presented with our front page, and there's a lot of sort of open access experiments on that page that you can undertake yourself now.

Things like the skull experiment is there. We have things like virtual microscopes. There are a whole range of things covering different areas. We have a showcase page, which we have particularly developed given the current COVID situation, so if you were to search for showcase, you would come across that. And that gives you some access to some of the other remote experiments, particularly the engineering ones there. So there's a whole range of Open access things that you might like to try now, or in between modules, or just when you have a little bit of time.

KAREN FOLEY: Wonderful. And just to end on, James, ever so briefly, what is the future for the OpenSTEM labs?

JAMES SMITH: So we're expanding all the time. We're looking at new areas of the curriculum where we might apply some of the methods that we've used already. One particular thing that we're developing at the moment is a wind tunnel facility that will be available for engineering students in the future. So there's a picture there of this sort of wind tunnel that students will be able to log into, and use, and sort of obtain, and then take away and analyse their own results from a real wind tunnel so not a simulation. It's a real experiment that you'll be undertaking.

And we've also recently produced what we call a Raspberry Pi cluster. So we have colleagues in the School of Computing who've developed a means for students to access a cluster of Raspberry Pis, where students can sort of learn about cluster computing and how that differs from just using a single processor for example.

KAREN FOLEY: Wonderful. Speaking of pies, I think it's time for a break, James. Thank you so much for filling us in. Katrina Bray, one of our colleagues, has put in the link for the Open labs in the chat and is also there answering your questions as well.

Thanks, Katrina, for helping Vic out. Vic's been ever so busy. Vic, time for a cuppa. We're going to have a break now and look at Amy's piece episode number one, how the OU helped me get my placement and the Open international Open diaries on Technology Enhanced Learning, and then we're coming back to talk about being a STEM student from a personal perspective. So join me in just a couple of minutes.

[MUSIC PLAYING]