Live Science

[MUSIC PLAYING]

KAREN: Hi, and welcome back to the Student Hub Live. Well, it's the last session of our day. And I'm sorry we took a little bit longer getting prepared, but as you can see we've had an awful lot to do. But most importantly I didn't have a lab coat, so somebody's had to go and get one. It's very important that we follow all the health and safety procedures. So without further ado, I'm going to introduce Nick Braithwaite. Welcome, Nick.

NICK: Hello.

KAREN: Hello. You do think I'm little bit over-prepared, but I've seen these things before and I've seen them go horribly wrong. But you've designed six experiments for us today.

NICK: I've got six experiments. They are all about radiation, but we're going to be doing it safely. I should say that it's not chemicals. We're not dealing with wet chemicals, which is why I'm not wearing a lab coat. I don't think it's required for that. And I won't be wearing gloves either, because I won't be directly handling anything that is sensitive. But it's quite sensible to be cautious, to do the risk assessment. Don't mind that at all.

KAREN: I'm to have closed toe shoes I'm told, as well.

NICK: Well done, excellent.

KAREN: Right, what are we going to do first?

NICK: Well--

KAREN: Do I need my glasses on then?

NICK: Well, I'm going to keep mine on. Let's keep our glasses on. It makes you feel scientific, keeps you in the mood.

I want to look at this question, really what is there that brings together microwaves, radio waves, infrared, ultraviolet, x-rays, gamma rays? What is it about those that is in common, but somehow different? Well, they're all forms of electromagnetic radiation, but they're all different forms. So I want to look at that spectrum.

We call it a spectrum. Really like the bench round here. At one end we have the radio waves and at the other end we have the gamma rays. We think of these as low energy phenomena and those over there are higher energy. And we're just going to go up the spectrum like that. Starting with radio, if that's OK?

KAREN: Lovely, yes, go ahead.

NICK: Well, I'd like to take you to our robotic radio telescope. We'll stay here, and we hope the camera will see a picture that I've got on screen, which is just showing on my screen now. There is a picture of a dish. It's a radio telescope dish. It's pointing out into space.

Radio telescopes have got the terrific advantage that you can use them during the daytime, so you don't have to stay up at night to use them. And this is pointing out towards the centre of the galaxy, and it's going to be listening out for some noise coming from hydrogen, some electromagnetic radio signals coming from hydrogen that set off 40,000 years ago.

KAREN: Wow.

NICK: So when they set off, we weren't here.

[LAUGHING]

Before we worked at University. Now let me just say something about the dish. I hope that we've got a picture of this dish on the screen now.

One of the things that always irritated me about these things is that people, when they see them transmitting or draw them transmitting--

KAREN: Here's my pointer.

NICK: Yeah, often draw something coming out of this little piece that's standing up here above the dish. But actually what comes out is a beam from the entire dish. And sitting in this little hub above it is the source, which is at the focus of this lens-- which is what the dish is, and that lens then would send out, if it were transmitting, send out a parallel beam. But it works in reverse as it does with your set-top sky boxes and so on. The dish out there-- it's receiving energy in across the area of the whole dish, and then concentrating it onto that detector.

We need to have a big area to collect, because it's a quiet signal. There's not a lot of signal. It's very, very quiet, but a very precise frequency. And it's associated with hydrogen atoms that just from time to time jiggle themselves a little bit and emit a certain amount of energy. There's an awful lot of hydrogen out there which is just as well, because it takes typically a million years for one of them to get around to do this. But we're not going to be waiting for one. There's billions of them out there. Billions and billions of them out there, so we get a continuous signal down here on the earth.

KAREN: Ah, this is great. And they're getting very excited about this in the chat room. It's brilliant.

NICK: Good, right, well, let's see what we see back here on the detector. I've got a graph here, which I hope is being visible. It's just at the bottom of the screen. There is a scale. In fact I could probably move that up the screen a bit, if I'm careful.

KAREN: Modern technology at it's best.

NICK: There is a scale across here, and there's a scale up there. The vertical scale is labelled volts, and that's the strength of the signal. And the horizontal scale, it actually says Doppler velocity in kilometres per second. Now you remember, maybe you don't, the Doppler effect. Have you heard the Doppler effect?

KAREN: Yeah.

NICK: Yeah? This is when a siren comes towards you, the pitch gets louder-- higher in frequency, as it goes away it goes down again. That sort of effect is called the Doppler effect. It happens with light, as well.

So when, whatever this hydrogen is out there, if it we're moving towards us, the frequency-- which is very special quantum mechanically determined frequency-- would be shifted a little bit higher. And if it's going away from us , it would be a little bit lower. So what we've got along this axis here, it's really an axis of frequency. And if nothing were moving at all, we'd have a very sharp line just across the centre of the screen there where I'm moving the pointer. But what we see is something that's broader and shifted to one side. And that's telling us-- I'm getting excited by this. I do every time. And it's slightly different every time.

What that's telling us is that there's more than one line there. That's made up of two or three lines overlapping, forming a sort of broader shape. And if you look up here just slightly higher up, there's a very shallow shadow of something also there as well. And it's a small signal, so it's a long way away. There's not a lot of hydrogen in that bundle, but it's moving considerably faster-- a 100 kilometres per second. That's moving towards us at 100 kilometres per second. But don't worry it won't be here any time soon, because it is 40,000 light years away in distance. It would take it 40,000 years to get here.

KAREN: Wow.

NICK: But what you can do from all this is you could work out the structure of the galaxy that were in. And it turns out it's got spiral arms, and parts of these spirals move towards us, parts of there spirals if we look the other way are moving away from us. And that structure is all seen on the radio telescope here. And this is part of an undergraduate experiment in physics and astronomy, and in about three weeks time we will have students working in groups of four from wherever they live, communicating over the internet with that radio telescope, listening out for the hydrogen that set off for them.

KAREN: Wow. And which module is this then?

NICK: This is sxpa288.

KAREN: Right.

NICK: The pa is physics and astronomy. The two is the second level, and then the 8,8 just makes it unique.

KAREN: So this is something that students will be getting together and doing, and combining the data, and actually participating in themselves? Wow! That's fantastic!

NICK: Yes, yes they pool their data to get to this picture of the galaxy.

KAREN: Excellent. That's super exciting.

NICK: All right, that's the radio spectrum. Now I want to go just a little bit higher in frequency, a little bit more energetic. And I've got this thing here, which you might recognise.

KAREN: I do, indeed.

NICK: What would you call that?

KAREN: Uh, it's a [? Poppity Ping ?] in Welsh.

[LAUGHTER]

NICK: What is it in English?

KAREN: A microwave.

NICK: Thank you.

[LAUGHTER]

In English it's a microwave. Microwaves are what comes along our spectrum after radio waves. Actually we will need just about double the frequency. This one here is a frequency of about 1.4 Giga hertz. This is 2.45 Giga hertz. It's just where we change over the names.

What I want to do with this one is to show you that we can change from one form of energy to another form of energy in a microwave. That's what you do. But still keeping it electromagnetic. Now what have I got in that?

KAREN: It's a so, well, nothing. Is it a light bulb?

NICK: Exactly, no, that's a very good answer, because I pumped some of the air out. So I got-- it's [INAUDIBLE] than that bulb of air. It's pumped some of it out, just to lower the pressure a bit.

KAREN: This isn't going to explode, is it?

NICK: I hope not. We'll be around the back. We'll be all right.

KAREN: OK.

NICK: I'm just going to put that in there, and I think--

KAREN: Why are the crew all crouching down?

NICK: I don't know. Is anything happening, [? Heather ?], people? Is it-- what can you see? Is it-- is it purplish?

KAREN: It's glowing!

NICK: It's glowing! Right, OK, I'm going to stop it now, because it gets very hot. And I'm going to carefully--

KAREN: And we mustn't do this at home.

NICK: Well, you won't have one of these at home to do it with. Don't think that this looks like a light bulb. Ah, by George! Don't think that it looks like a light bulb, so you could do that. Because a light bulb's got metal parts in and they would--

KAREN: Explode.

NICK: --play havoc with the microwave. Just without touching it. Feel that. Radiantly hot? OK, so you're now experiencing some infrared radiation coming from this. While it was in there we were seeing a glow. We were actually making an ionised gas. We call it a plasma. Its actually what my research is about-- ionised gases. And we were using the microwaves in there to generate that plasma, to break the atoms up, to ionise them, to pull electrons off, to make them an electrically conducting medium which is used-- oh, let me see-- it's used in lights, fluorescent lamps. It's used in the semiconductor industry for making all your chips. You couldn't have chips nowadays without using plasmas to do things to them. It's a fascinating medium. And I absolutely love it.

But we did that with the microwave energy that was in there. And in the microwaves-- in all electromagnetic waves-- there's very high electric fields. And as this thing moved around in there it found regions of high field and it sort of glowed a lot and then it went into a quieter region and glowed a bit less. It's cooling down enough now I think for me to be able to put it away. OK, here I'll just pop it back in this cardboard box, and put it safely out of the way there.

KAREN: Lovely.

NICK: Right so where are we on our spectrum? We had a radio microwave and infrared.

KAREN: Infrared.

NICK: We just talked about a little bit. That was infrared real power and we use that for cooking.

KAREN: Oh, we can't watch any TV here, Nick.

NICK: We can't? Does this work? Is this one that we can work? Over here, I think, can I point one of these? How about that? Is that working? This is now signalling with infrared. It's interesting. Not all cameras now can see that. It used to be that mobile phone cameras would pick that up very readily. And then they realised that they were too sensitive to the infrared, giving you a rather bad picture when you just need to capture the visible. So they put filters on now to keep that out. My latest phone doesn't see that, but I think we found one of the cameras in here that would see the signalling coming out whenever you press a button on a remote control.

KAREN: Wow!

NICK: Sorry, you thought I was going to watch television.

KAREN: I did as well.

NICK: That was something else quite good.

KAREN: I know. There's good props here. You've got some other fantastic things. What else have you got?

NICK: Well, we've gone now through the infrared. We're going to skip the visible because everything's happening in the visible for those that are able to see it.

KAREN: Oh, yes because a lot of this was about the invisible.

NICK: Yes, this is the bits that we can't see. And I'm trying to make some of those things visible, making the invisible visible. Now these--

KAREN: Are these marbles?

NICK: --are marbles.

KAREN: Right.

NICK: But they look a little bit greenish. I'm just going to put two of them on there. They're OK to handle, but they're made of uranium doped glass. There's a small amount of uranium oxide in the glass. And what that does is it fluoresces. Now fluorescence is when you take some energy and move it down the scale from that end of the sofa to this end. So, I'm going to put ultraviolet on there.

KAREN: Wow.

NICK: And you see that it glows back at me green as a result of this ultraviolet light in the torch. Now one of the things that one might worry about with glasses is whether or not they cut out UV. So let me just try and shine that through there. And that-- is that?

KAREN: I can still see it green.

NICK: But it's less, isn't it?

KAREN: It is less, yeah.

NICK: It is less. It is less. I've got an even more radical experiment here. I'm going to use my own glasses, which is difficult because I can't see what I'm doing now. But let's try that. See that one doesn't--

KAREN: Oh, nothing, yeah.

NICK: Cuts it out completely, so I'm quite happy with these glasses that they stop too much UV getting into my eyes.

KAREN: As if those are just normal glasses? They're not--

NICK: Yes, yes but it's a bit quite thick.

KAREN: Right.

NICK: They're thick plastic. I'll pop those back on, but I got one other thing. It just occurred to me. The thing about science, or the scientific method, is that it's full of what if's. You've got to say, well, what if we do something else? And then think about it carefully, do a risk assessment, and then have a go. So I did a little risk assessment on this. This says 50 plus, very high. And it's not talking about me, it's talking about the sunscreen. And this is sunscreen. I'm just going to put a little bit of sunscreen on one of these beads, and let's see if it's any good at keeping ultraviolet out.

KAREN: So is this how they test them? Sunscreen--

NICK: Well, it would be one way.

KAREN: To see effective they are.

NICK: It would be one way. I'm not saying they do it with uranium marbles. Let's just pop that back on there and see if it has any effect whatsoever.

KAREN: Should we turn it, so the audience can see this as well.

NICK: Well, we'll turn it to about sideways and they might see a shadow.

KAREN: Oh, wow.

NICK: I can see there. I don't know where the best angle is. When I come from this angle--

KAREN: Yeah.

NICK: It doesn't get as excited as when I come from that angle.

KAREN: Right.

NICK: I don't know if we've been able to pick that up on the cameras.

KAREN: Should we turn it around like this way maybe as well, so that people at home can see?

NICK: Is that better? So from the top we get it quite bright. From this side, I mean, this is supposed to be 50 plus. I can see from here. Can you see, Karen? It's a little bit darker and there's a bit of shadow in there--

KAREN: Yeah.

NICK: --caused by having the sunscreen on it. Compared to that one side.

KAREN: Does it matter how thick you put it on in terms of how much then that would protect?

NICK: Yeah, and you're already halfway to being a scientist here with that method, because you say, what if? What if we put on more? Why don't we do the experiment?

KAREN: More, more, more! [LAUGHTER]

NICK: We need to go further on around the spectrum, otherwise we could. Because I think that would be a nice thing to do. You could set up a little test to do that, absolutely.

KAREN: Lovely. OK, so what next?

NICK: Right, well, next I would like to go to the x-ray part of the spectrum.

KAREN: Oh, let's.

NICK: But unfortunately we've been let down by little bit of technology. And I had an x-ray experiment arranged in the lab, and we can't quite get over the network to it at this last minute.

KAREN: OK.

NICK: So I apologise for that, but I will appeal to x-rays, because actually I think most people these days know what x-rays are. They have them all the time. I was at the dentist recently and I had several in a row. And I used to get worried about this. But they just use less and less now, because they're getting better and better detectors. And they used to use film. You know, put a piece of film in your mouth?

KAREN: Yeah, yeah, yeah.

NICK: They now put a piece of electronics in your mouth, actually, which is why they can show you the picture of it straight away. There's no developing of the film and so on. X-rays another part of the spectrum that's taking us around, [INAUDIBLE] radio, microwaves, infrared-- skip past the visible-- and we went on to the ultraviolet. And we've just seen ultraviolet there made visible through this process of fluorescence. And then if we go a little bit further, we going to get into the gamma ray portion of the spectrum.

KAREN: Lovely, now at this point, I just need to have a safety announcement and just remind people-- we're talking about putting lots of things in microwaves. And I must remind everybody that they are just for food so please don't put things in the microwave that shouldn't go in the microwave.

NICK: Quite right. I'm happy for you to say that. This is a special microwave for the purpose of demonstrating plasmas found in microwaves.

KAREN: It does. It's got all these certificates on it.

NICK: Yeah, OK, good.

KAREN: A very well-educated microwave.

NICK: Quite right, quite right. But we do like to play.

KAREN: Oh, yes, indeed! And we like to watch you play.

NICK: Can we go on then to the gamma ray portion of the spectrum? That's the very energetic part. And you get gamma rays from-- well, there's a lot of stuff out there in space, in that it's really high energy stuff. And you also get it on earth around nuclear radioactivity, which is another type of radiation. And so the best way to talk about some of this is to have some radioactivity.

Now radio activity is not electromagnetic radiation unless it's the gamma ray [INAUDIBLE] other things. We call it alpha radiation and beta radiation. And what we're going to do is we're going to look at some of that now. But I need, please, to have some radioactive material carefully brought in at arms length. There we are. And here we have in a bag-- I'll have to be careful about this, because it's in two bags--

KAREN: It's OK. You can do film and stay please.

NICK: Don't go away. I've got some tongs, so that I can get it out, and we get a closer look. I'm not going to handle it directly, if I can avoid it.

KAREN: Did someone send you this in the post?

NICK: Effectively, yes. There is a piece of a rock that was picked up on a beach. And if we were get in close to it-- I don't know if you can get in close-- but one can see dark, almost black--

KAREN: Bands.

NICK: --veins going through it. And the occasional bit of yellow. In fact we can give-- I've asked James to leave word of a website where we've got a microscope image of this that people can go and look at and handle, so to speak, perfectly safely because they just see an image on the screen. And they don't need to handle it with tongs. We've got here something that makes radiation of this sort audible. This is a Geiger counter. For example with that we got uranium. You see? Uranium is a little bit radioactive, [A FEW CLICKING NOISES] but not very much. There's not very much of it there. How does that compare with this? [MANY CLICKING NOISES]

KAREN: Oh--

NICK: OK, you're hearing the clicks.

KAREN: Yeah.

NICK: Are the clicks being heard? Are the people hearing the clicks good?

KAREN: Can everyone hear, OK?

NICK: OK, it's also showing up on this metre here as counts per second. What's happening is that particles are being emitted from some of the atoms in that rock as they change from being atoms of uranium and possibly to being other atoms. That's the radioactive process that you get elements changing from one thing into another-- emitting alpha particles. Or just shaking up their energy, emitting beta particles, or just generally settling down after one of those processes has been going on emitting these Gamma rays, which are right at the edge of our spectrum.

Now we ought to be able to stop that somehow. Let's take one of the marbles and put it--

KAREN: It's still going.

NICK: Well, it goes down the distance. This one goes around the distance, because we're intersecting less of it. It's going out equally in all directions. And also, maybe, whatever's coming hasn't got a very large range. I'm going to take a piece of this aluminium sheet and just pop it over there. Let's see if that makes it any less noisy as we get close. [A FEW CLICKING NOISES] That's with the sheet in place. [MANY CLICKING NOISES]

KAREN: Oh, wow.

NICK: Without, did you spot the difference? What would be the explanation of that I wonder? [A FEW CLICKING NOISES] Yeah, that's definitely reduced, isn't it? And if I were to put another sheet of aluminium that was a bit like putting on two bits of sunscreen that you wanted to do.

KAREN: Yeah.

NICK: Let's put two layers on. [LESS CLICKING NOISES] [INAUDIBLE]

KAREN: Yeah, there's hardly any, isn't it?

NICK: [INAUDIBLE] we stop it altogether, just not getting through.

KAREN: So is the tiny bit, because it's on the side? Because that's a square and that's a circle? Is that what's happening?

NICK: Yes, and also the cosmic rays can probably get in and create a little bit of noise in there as well. There's a bit of what's called background radiation tends to get through everything. But we were stopping the main particle flow, which I can determine from the fact that it's been stopped by that those little alpha particles and possibly some betas in there and the decay processes that's going on. [MANY CLICKING NOISES]

KAREN: You mentioned that students can do this online and that that might be a safer way of doing this as well. Is this harmful?

NICK: Ah, yes you wouldn't want-- I mean this is what killed Marie Currie.

KAREN: Right.

[BEEP NOISE]

NICK: Harmful in those terms. It took quite a lot of it, but what she was doing was she was taking this kind of stuff and extracting from the ore the uranium oxides.

KAREN: Can we put it back in the bag?

NICK: Well, we can.

[LAUGHTER]

It would have to be an aluminium bag to be terribly effective, but the polythene will tend to stop the alpha particles.

KAREN: Not that I'm nervous--

NICK: No?

KAREN: But, of course, there is aside from the health and safety, there is a benefit. Is this a radioactive bag?

NICK: No.

KAREN: There is a benefit in students being able to do some of this online. Tell us a little bit about that. How does that then work?

NICK: Yeah, I'll put it down there for now, and we'll pick it up before we leave the studio.

KAREN: Yes.

NICK: Well, I might have to leave in a hurry, actually. If I do, could you have somebody just put it away carefully for me? Yeah, we've got the Open Science Laboratory which is how we do some of this online. We show the radio telescope. That was a nice online experiment. We have an optical telescope. We deal with it the same way. We are planning an experiment where you can do radioactivity safely from a distance like that. And it makes a lot of sense.

An awful lot of science can be done really without touching. You need to be able to have things happen, but you don't necessarily have to be part of the experiment. In fact it's good science not to be part of the experiment. It's good science to set it up so that all you do is you're the observer. And the open science lab lends itself to that, because the students are not in the same place. Once you've got to the other side of the room you might as well be in a different room. Take your keyboard and screen and go further away. And then you could be anywhere on the planet. You could be on Mars.

KAREN: And the other benefit is that you could collect a lot of data, couldn't you? You could have a lot of people measuring certain things, and go quite quickly I guess.

NICK: That's absolutely right. You can do things using the fact that the population is distributed. We could do water surveys. We could do biodiversity surveys, citizen science activities. And all of those are communicated through the Open University's open science laboratory, which we're extending. We're building it in virtual space to call it the Open STEM Lab.

KAREN: Right.

NICK: Well, now that will be Science, Technology, Engineering, and Maths. And we have a huge investment of money at the moment doing that, building more things like that robotic telescope.

KAREN: Ah, fantastic! Well, thank you for showing all of us-- this to us. It's been absolutely brilliant. I'd like to get to the social media desk, and see what's been happening in the chat.

HJ: Yeah, well, some people are quite nervous and glad they're not here. And Natasha says, we're all going to wake up with extra toes, which I really hope I don't. [LAUGHTER]

HELEN: Yeah, no, it's great. I'm loving all the chat. People are getting alarmed on our behalf. [LAUGHTER]

NICK: Well, let me reassure you absolutely the amount of radioactive that we've had in the room just now is not enough to do in a normal lifetime that type of damage. High dose is what might Marie Curie had. And quite a long life, but it wasn't as long as it would've been if she had not messed around with the uranium.

KAREN: Well, thank you so much, Nick. I know you have to go. Where are you off to?

NICK: Well, we're going to-- I have to be on Pitch. This was pitchblende in there. I now have to go on Pitch, and France against Canada Milton Keynes stadium. So if you'll excuse me, I think I'm probably going to be off.

KAREN: All right, well, thank you so much Nick. I know our audience loved that. That's been brilliant!

NICK: OK.

KAREN: Wonderful! Well, I certainly enjoyed that. I'm not quite sure about that radioactive material.

OK, that's the end of the Student Hub Live. Phew, what an ordeal. We've eaten so many biscuits, drunk so many cups of tea. I haven't had nearly enough tea during this whole process. But that's been the end of what has been a fabulous two days. So I'm just going to thank a few people. In fact I'm going to thank quite a lot of people who've been here through this whole process, presenting and doing various things. I've got a list of them I'm going to go through as well. But most importantly, I wanted to thank you the audience at home for sitting and enduring what has been a really jam packed programme.

So HJ and Helen, how are we going to conclude and sum up all of the chat and all of the amazing communication? And have you got anything else that you'd like to add?

HJ: Well, it's just so hard. It's been so fantastic--

HELEN: It really has.

HJ: --and lots of stuff going on. And we've had so much stuff sent in. [BELL DINGS] But--

KAREN: Oh!

HJ:-- I suppose that's quite lucky, since we're finishing up. We've been warned about it. Let's have a quick look at our final inbox delivery of today.

[INTERPOSING VOICES]

HJ: Let's get the spam filter out of the way. And, oh yes, we've had a firewall installed, so we think that sorted out the glitches with the spam filter. But let's see what we've got here.

KAREN: Lovely, that's a great plan, because I know that spam was really bugging you. It's still under the desk.

HJ: Yes, yeah, we've got a bit of it. So that will feed--

KAREN: A bit?

HJ: --us for a while, won't it? I think. [LAUGHTER] But we've had some lovely stuff sent in from the [? part-time matters ?] company. It's been absolutely fantastic. A lot of people graduated today, as well. So congratulations to them. They got families and friends show their support for the campaign there. And hailing from Wales, as well, we've got showing there support for the campaign. And I absolutely love this. Laura has been knitting a cushion while she's been watching us over the past two days, so she decided to send in a picture of the finished [INAUDIBLE]. So looking all lovely there and--

KAREN: Well done, Laura! Good to see you've done something constructive in addition to eating a lot of biscuits and food like we all have. [LAUGHTER]

HELEN: And I'd like to finish on a study buddy, because we've had a theme of study buddies over the last two days. And this is Peter's study buddy, Winston. Isn't he a cutie? So yeah so thank you for sending in all your photos of your pets and your study buddies.

HJ: Yes.

HELEN: And we've put your selfies and your shelfies up on the board and it's looking really full now. It's looking fantastic.

HJ: And we've had lots of great information and tips that we've had come through. So I really loved when we were talking about cassettes and the first cassettes. That was really neat. And when Susanne said about how meteorites sample the solar system. That's really awesome.

HELEN: Yeah, and we've had really encouraging chats in the chat room. And one of the comments I really loved was from Anne. She said, go for it. Don't let anyone say you can't do it. Which is fantastic, I think.

HJ: Yeah, but we've absolutely loved it. And if anyone wants to keep in touch, we have our email address. If you want to send anything else to us, your thoughts, feedback. If there's something you still want to know, studenthub@open.ac.uk so make sure that you do that. We'd love to hear from you. But, yeah, we've just absolutely loved it.

KAREN: HJ and Helen, you have done the most fabulous job keeping up to speed with that. I must say, you know, I've tried it. And it's very, very, very difficult. So thank you so much.

And I know that our audience at home really appreciate what you've been doing, so that's been absolutely brilliant.

But listen, like they say, we'd love to know what you think. So do email us, if there's anything outstanding that we haven't quite had time to cover. We also have a survey, which I'd love you to fill in. It's a very quick and easy survey. Or you can give us your details, and arrange a quick 10 minute telephone chat about your experience-- love to do that also. You'll see a Count Me In button on the website. So if you're counted in, you give us your email address and we'll tell you when the next event is on, which is most likely to be around February for our new intake of students.

And while I thank everybody I've managed to persuade to come along, I'd like to start with a new Wordle to leave with. So I'd like you to-- if you are watching the live and interactive, put three words that sum up how you're feeling right now. I'd love this to be a sort of a summary of how you found the event. So that'll be appearing on your screen, and if you could add those words about how you found the Student Hub Live, I'd love you to be able to fill that in.

So these are the people I have managed to persuade to come along, and let me tell you not many universities would have all of their top brass showing up. And a range of people from all of the faculty's have come along.

We've had Belinda Tynan, Kevin Hetherington, Richard Brown, Martin Upton, Susanne Schwenzer, John Butcher, Klaus-Dieter Rossade, David Han, Marion Hook, Valerie Demouy, Janet Sumner, Peter Horrocks, Sam Dick, Anne Marie Gallan, Ellena Whites, Leanne Daniels, Liz Chamerblain, Vic Pearson-- I'm never going to make it as a news reader, am I?-- David Rothery, Allison Little John, Engin Isin, Francesca Benatti, Meg John Barker, Linda Robson, Sue Goodyear, Cherry Day, Debbie Britton, Wendy Mears, Catherine Moore, Gemma Briggs, Hazel Rymer, Kevin McConway, Jonquil Lowe, [INAUDIBLE] Sean Cordell and Sophie-Grace-- that was a good ethics discussion. Ellen Cocking, Liz Marr, Sally Crighton, Katie Chicot, Peter Taylor, and Nick Braithwaite.

What a lot of participants we have got through in the last few days. And if you have missed any of that or you'd like to see it again, you can watch it on Catch Up. But I've been Karen Foley presenting-- we've also had Klaus-Dieter Rossade and Liz Marr joining me in that process of doing that. And, of course, HJ and Helen have been amazing on the social media desk. But that's not all, because we've had a lot of other people involved. We've had KMI, Our Knowledge Media Institute, Ben [? Wholekridge ?], Chris Valentine, Trevor Collins, Kevin [? Quick, ?] and John [? Domingas ?] have all been really supportive of the event.

We've also had the set design by Ray [? Furley ?] and Sophie [? Furley ?]. We really appreciate the new social media board and the mailbox, which is going down a treat so thank you for that. Learning and teaching solutions, we've had an Eleanor Dodd and Adrienne Golding who've been doing a sterling job backstage in dealing with all of the queries and things that have been coming through. But also Meg Smith, Lawrence [INAUDIBLE]-- sorry about that Lawrence-- Sarah Wilkinson, Richard Howes, Celia Copping-Meylor, Joel Beckford, Ben Hogan. We've had OMU, our Open Media Unit, and we've had Sass doing a lot of work for-- [INAUDIBLE] doing that.

And in our studio Kate Booth, Rush [? Niamon ?], [? Mass ?] Compton, Joe [INAUDIBLE], Owen Horn, Jim Hoyland, Angela [? Lemont, ?] Bernie Savage. And not to forget, Andrew

Ricks whose made it all hang together. And our communication department, Lucy [INAUDIBLE], Tracy Buchannon, Louise [INAUDIBLE], Sally Ann Slater and her team for telling students about this event. So thank you everyone. What a lot of people involved in making this all happen. It's been absolutely amazing. I always get very sad disconnecting with everybody, but do Count Us in so that we can keep in touch with you. And of course fill in our survey so that we can hear how you found it all.

Oh, Helen, thank you! Are we going to be friends now about the desk thing? [LAUGHTER] Ah--

BOTH: Thank you.

HELEN: And Happy Birthday for yesterday.

KAREN: Oh, yes, thank you. It was my Birthday yesterday, and I thought what better way to spend it than on the Student Hub Live. So thank you very much.

And thank you at home. Your kindness, your ability to share with each other, you're supportiveness has been so incredible. This is what being part of the OU community is all about. And I'm so pleased to be a part of it and I hope that you are too.

Good luck with your studies. There's [? Usa ?] radio on tonight, so if you still fancy being engaged, do attend that. That'll be a really, really good laugh. So get involved with that. You can see that on their website from the Open University Students Association.

But that's all for now. And we will see you next time, and do keep in touch, and be Counted In. See you very, very soon and enjoy the rest of your evening. Bye.

[MUSIC PLAYING]