# EDUCATION AND HEALTH
# STANDING COMMITTEE

## INQUIRY INTO DIGITAL INNOVATION IN SECONDARY EDUCATION



**TRANSCRIPT OF EVIDENCE
TAKEN AT PERTH
WEDNESDAY, 14 AUGUST 2019**

**Members**

**Ms J.M. Freeman (Chair)
Mr W.R. Marmion (Deputy Chair)
Ms J. Farrer
Mr R.S. Love
Ms S.E. Winton**
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**Hearing commenced at 10.47 am**

**Associate Professor ERICA SOUTHGATE**
**Associate Professor, School of Education, University of Newcastle, examined:**

**The CHAIR**: Welcome, Erica, and thank you very much for giving evidence today. On behalf of the Education and Health Standing Committee of the Western Australian Parliament, I would like to thank you for agreeing to appear today to provide evidence to the inquiry into digital innovation in secondary education. My name is Janine Freeman and I am the Chair of the Education and Health Standing Committee. The other members of the committee who are with me today are Sabine Winton, the member for Wanneroo; and Ms Josie Farrer, the member for Kimberley. The Kimberley is probably bigger than Victoria in terms of its landmass; it is a very large part of Western Australia. The other two members, unfortunately, are unable to attend today and send their apologies. Sitting next to me is Sarah Palmer, who is the clerk/research officer for our committee. I am not sure if you can see Hansard over there.

You have agreed to provide evidence to the committee. Your evidence is protected by parliamentary privilege in Western Australia, and protected by uniform defamation laws in Australia against actions in defamation. Please note these protections do not apply to anything that you might say outside of today's proceedings. It is important that you understand that any deliberate misleading of this committee may be regarded as a contempt of Parliament.

Before we begin with our questions, do you have any questions about your attendance here and our inquiry or anything you would like to know before we start?

**Prof. SOUTHGATE**: I read the terms of reference. It is interesting that you are doing this inquiry. I think it is very timely. Certainly, I hope what comes out of the inquiry is a blueprint for what innovative technology and technology enhanced learning should look like in schools.

**The CHAIR**: It is interesting to us because I think you are right; we are right on the edge of how this is looking for schooling. We received a submission from one of the areas of education here. It just really went through the curriculum and what the curriculum looked like and how it delivered the curriculum in this area. For us, we felt that it misunderstood what we were trying to achieve. From your point of view and the sort of research that you are looking at, what is the idea of a blueprint that you would see that would be worthwhile to deliver to the community and make them think a bit more openly about this?

[10.50 am]

**Prof. SOUTHGATE**: Just yesterday, the Australian government released a report that I had written on artificial intelligence and emerging technologies in school education. That is available.

**The CHAIR**: Yes, we have that.

**Prof. SOUTHGATE**: That does provide a blueprint, I suppose, of the current evidence base and also some case studies of schools that are putting these emerging technologies in place in relation to curriculum-aligned learning. It also had a national consultation component. I spoke to experts around the country about what they thought the main strengths in the areas were, what needed to be done, but also some of the challenges for school communities. That provided very insightful information. That is in the appendix of the report, but it is very, very insightful in terms of the current challenges for these types of technologies. That report provides a blueprint for us to go forward.

I suppose when we talk about technologies, we need to decide what sort of technologies we are talking about, because each of them comes with different challenges and each of them comes with different learning possibilities. The type of research that I conduct is around artificial intelligence and school curriculum and also around what teachers and principals—school leaders—need to know about the ethical issues related to artificial intelligence and bringing that into school communities.

The other part of my research is on virtual reality or what we call immersive learning—the use of virtual-reality platforms for learning. I have also developed serious computer games, so thinking about learning through computer games.

**The CHAIR**: I went on and downloaded your app and put my full stops in the spots. I only went through a little bit of it.

**Prof. SOUTHGATE**: What is interesting is that they are designed for students at university with gaps in their literacy. I work in a university that provides access to many, many students from what we call non-traditional student backgrounds—students who are underrepresented in higher education. We find that often they do have gaps in their literacy, but we can easily fix that if we provide mobile learning tools such as games. I have produced a number of games so far and they have been evaluated quite successfully for building literacy knowledge.

That is my three main areas of research. Each of them comes with different possibilities and challenges, I suppose.

**The CHAIR**: In terms of the challenges, how do you foresee that you work through those sort of challenges with schools, given how busy schools are and how busy people are in that space? Sometimes changes in technology can be pretty overwhelming. Kids can be really up to it. But in that space, how do you see that that can be done in a manner that does not overburden our educators?

**Prof. SOUTHGATE**: I think we have to start with the area of digital inclusion in this country. We have a very, very serious problem around equitable access to digital technologies, but also to broadband and bandwidth and data, which schools and children can use for learning purposes. Although there have been current debates around the use of mobile phones in classes or having mobile phones in school, that really distracts, from my perspective, from the key issue, in that we can use these digital technologies for learning but often students do not have access to the latest or the best or optimal types of hardware or software that they need and the types of broadband and bandwidth that they need for learning. When we talk about schools, we really need to situate schools within very differential contexts of access to digital technology, hardware and software and teacher expertise and training. We need to tackle this pretty seriously coming into the future. Many private schools have invested in wonderful laboratories or maker spaces, which include virtual reality that look at teaching of artificial intelligence, and that can really fire up interest in robotics, for instance, through their training. From my experience, you do not see that very often in public schools, because public schools really do not have those types of resources to spend on the technology. What you do see in public schools, however, is incredible creativity from teachers in terms of harnessing what access to hardware and software they can get hold of, and really interesting and innovative innovation in terms of thinking how to leverage the Australian curriculum to make learning more engaging with the technology. What they might lack in hardware and software, they certainly do not lack in pedagogical expertise or the ability to take some risks with learning with new technology.

I think we cannot think of schools as one thing. A really good example of that is that many virtual-reality platforms are going to be delivered through streaming capability. If you are in a rural or remote school community and you have limited bandwidth, there is no way you will get access to

streamed virtual-reality platforms. That will automatically create a barrier for students in that area, even if students and teachers and the community want to get involved in using the technology for learning. To me, that is something this country has not really addressed in any systematic or meaningful way.

**The CHAIR**: You did your report as part of the federal government's artificial intelligence capability fund, but you would have obviously worked with education departments, particularly the New South Wales education department. So from an overall management point of view, that sort of higher level from the schools, how do you think education departments are dealing with the challenge around ensuring that, first, the capabilities are there, but also the distribution is there so that you do not get inequalities around this sort of delivery of resources to kids?

**Prof. SOUTHGATE**: Education departments obviously deal with this at a policy and procedural level. They have to deal with other departments, though, in terms of, for instance, access to NBN or satellite or broadband, and for kind of ring-fencing the data allowances for schools, so it is not just about education departments understanding the importance of this. I have worked with NSW, and, more recently, the South Australian Department for Education government schools. They are doing amazing jobs at really pushing out new technologies and supporting that with professional learning material, and with access to the hardware and the software. For instance, the NSW Department of Education has something called STEMShare, a technology for learning program, where they send kits out to school. Schools can obviously trial the hardware and the software. That is accompanied by lesson plans and professional learning material for teachers. It is really a twenty-first century version of a lending library that goes out into the community, and schools can try before they buy. The CSER at the University of Adelaide has the same lending library approach. In both cases, despite reasonable resources going through, there will never be enough hardware and software to go around. There are still long waiting lists, and schools need to give that hardware and software back before they make decisions about what they will invest in. There are some very good programs or models out there, but they are not up to demand. Schools obviously want to try new technologies, and teachers want their students to have access to it, but, yes, there is just too great a demand in the public system.

[11.00 am]

**The CHAIR**: When you say they send out these kits to schools, would that include virtual reality packages? Would it have all the technology that they need, the physical hardware that you are talking about, to do the virtual reality? We went to Honeywell, because they use virtual reality for some of their operations. We were there with the big screens in front of our faces, trying to fix machinery and things like that. I assume that is the sort of aspect that we are talking about in terms of virtual reality. AI is obviously a bit different—I am still coming to terms with those things myself. We have schools—you would have them as well—where Google has come into the school. I am wondering how that interplays with those technology companies and what they are delivering into schools. Are you aware of what they are providing to schools?

**Prof. SOUTHGATE**: That is a great question. There is a lot of professional learning in this area being delivered by technology companies. Ed tech is big business, particularly big ed tech like Google and Microsoft, for instance, but smaller technology company start-ups in Australia are trying to get into the market as well. That is heartening to see, because I think they often have a much better grasp on local conditions. During the consultation phase for the AI emerging technologies report, one of the things that was highlighted was that most professional learning for teachers now is being offered by the technology companies, and that is in relation to the products that they are selling. We have to decide, as an education community, whether that is adequate or whether we need more

independent and often evidence-based professional learning delivered through other sources. Certainly universities can provide that to a degree, but we are not set up to deliver professional learning on the scale that technology companies can achieve. That is a key question.

I think in the area of technology ethics, there are some key tensions. Some of those tensions include the potential for what we call regulatory capture. I do not know if you have heard that term. It is where the provider of the goods or the services also provides information to the government on whether the goods or services are safe or ethical for use, and the government relies on that advice solely, with no independent advice given or experts to draw on. It is particularly an issue when artificial intelligence is infused into applications, because you cannot really tell it is there. For most artificial intelligence, you cannot tell that it is there; it is working in the background. It is harvesting lots of data. Often we do not now know what data we are giving away. Certainly children do not know necessarily what data they are giving away. Teachers do not know that either, when they bring apps into the classroom, that this data is harvested and may be used for purposes that they never thought it should be used for, actually. Increasingly there is the use of vision learning, which is the way in which machines can scan environments, including our faces and our bodies, to harvest data around what we call biometrics. That can be facial recognition, but it can also be things like how we type on a keyboard, or how we move in space when we have tracking technologies with virtual reality, or it could be eye gaze—for instance, where we direct our eyes. Increasingly, this type of technology can capture that information and we do now know it is being captured, and it can be used for various purposes.

Under Australian law, my understanding is that under the privacy legislation, that would be considered sensitive data. Unfortunately, Australian law is not like the GDPR, the European law, which mandates that before you collect biometric or very sensitive data from people's bodies, you need to ask for permission—consent—and people need to know what data they are giving away. We do not have that. But under the privacy legislation, we do have provision for sensitive data. I am told, from correspondence with the privacy commissioner, that biometric data would fall under that. The issue is, though, that these kinds of technologies will be infused into applications, including virtual and augmented reality, and other screen-based applications. The issue is: What are we willing to give away? Do we know we are giving it away? How can teachers, school leaders and students be empowered, really, to understand the implications of that? That is a key issue that is upon us now—that has emerged now. It is very, very complicated.

**Ms S.E. WINTON**: Just on that, Erica, it is obviously an organic thing, and some schools shine and drive forward with this kind of stuff. Are there any regulations or any states where there is some sort of mechanism through which there is a watch over what technologies are being used in schools, or is it very organic and flexible in terms of schools? I see that as a strength, but obviously you are flagging that that is a risk as well.

**Prof. SOUTHGATE**: The more decentralised the schooling system, the more likely you are to have less centralised policy advice or regulation around it. In other words, to decentralise schooling, where the principal is in control of budget and purchasing decisions, and where they bring in, for instance, their own learning management system and decide what learning management system they want to bring into the school, the principal makes those decisions, probably with their learning technology team at the school. Probably the key issue, as many of us are grappling with issues around artificial intelligence, around big data and around the harvesting of big data, is: what kind of expertise do you need as a school leader to make good, ethical decisions around that? You do need quite deep expertise. Where can you get advice? I mean, the state departments that I know about do not have strong policy on that yet. They are moving towards it because they recognise it as an issue. Part of the reason the team and I were commissioned to do the report was really to highlight

the complexity of these issues and what it might mean for teachers. But when a school principal decides to buy a learning management system, what sort of questions should they be asking about data, data harvesting and data use, and also about the types of decisions that artificial intelligence will make for you within schooling systems or learning systems? This becomes complicated and difficult, but the team argues in the report that we really need to build the foundational knowledge of teachers and school leaders in regard to what these technologies are, what they can do, how we can use them for good, and what they are good for in schools, and also around the kind of ethical and safety issues, because we are playing catch-up here at the state and commonwealth level in terms of regulation, and on-the-ground advice to teachers and school leaders.

**The CHAIR**: We are still effectively without an ICT vision statement in our Western Australian education department. We have an old one, but not an updated one. Do you know of any states that are at the forefront in terms of that sort of foundational vision about what you want, but also about how you can have a process for making decisions around what you want to bring to the school, what parameters you will put around it, and how you will ensure that people are giving the right permissions and know what will occur with the use of this data? For example, if Google is coming in and running a classroom for you, what conversations will you have with Google to ensure the protection of students' data, the biometrics and those things that you have raised? Are there good examples of that anywhere else in the country?

[11.10 am]

**Prof. SOUTHGATE**: This type of policy work goes on behind closed doors. The kinds of decisions that are made at department levels go on behind closed doors. This is not a transparent field. Historically, there has been a gap in the market, and the tech companies have filled that. It is not so much that Google will come in and run a classroom, but Google will sell you a suite of learning products which all your students will use, and then their data will be harvested from that. The policy work around ethical and safe decision-making at a governance level is currently happening right now in terms of state departments. The best thing would be for you to contact them directly, because that will not be transparent and it is certainly not easily publicly available. I think it should be. I think we should all know the kind of information that we are giving away through the systems that we use in educational contexts, but it is not transparent at the moment. So if you are asking me, because I am not in policy, I do not know, but I know that I cannot see it on the websites. I have not seen any clear regulation around that, for any industry, really, in Australia. The whole world is grappling with this at the moment.

**The CHAIR**: You were saying before in terms of how your eyes shift or how you use your keyboard. What use do they put that to? Can you just give us an illustration of what might happen with children?

**Prof. SOUTHGATE**: One of the interesting things is that I came back from the big virtual reality conference in Osaka in March, and there was a lot of talk about using eye tracking in headsets. The headset has a program built into it or a functionality that tracks the gaze or the eyes—where they land when you are in a virtual environment. They were talking about—this is obviously the software engineers who are building educational products—that this will be a proxy for engagement, of whether a learner was engaged or not with their environment, where they were looking and for how long they were not looking. It very well might be a proxy measure for some students in terms of where they are looking and how engaged they are, but there is no good evidence that that is the case, actually, in research. There is no good evidence for that. There have been some small-scale studies where they have tried to correlate gaze with achievement—marks in a pre and post-test— but, really, there is not great evidence for it. We all know that sometimes we can look at people but

not be engaged at all. What is going on? It is very complicated. Just the thought about them putting eye tracking in programs, in headsets, and harvesting that data without you knowing, and then developing other products in terms of feeding it back to teachers through a dashboard, for instance, and saying, "Look, you had this many engaged students, these ones are engaged", is really not evidence-based. It is certainly a blunt measure of engagement. Most recently, I have heard a technologist from a very big tech company talk about putting cameras in classrooms to do facial recognition, which could then tell a teacher who was engaged and who was not, and what their emotions were. Somehow, the teacher would use this to manage the classroom. There is no evidence that we can use facial recognition technology accurately to know people's emotional state, and certainly not those of students, and that this could be used well in classrooms for behavioural management purposes. In fact, I asked: "Would any of us like cameras trained on us in our workplace, and our bosses reviewing that data through dashboards to know if we are engaged and on task?" and the room said, no, they would not like that. So I would argue: why would we do that to children? This is an invasion of children's human rights. We all have the right to bodily integrity, bodily autonomy. This is information about our bodies. It is not of ourselves, it about ourselves directly. We should have control over that. Children have a right to assent as well. They have digital rights, as well as adults. We need to think really careful about how technologists are talking about building and using this technology. I have seen it marketed through conference programs in this country about the great surveillance systems in Chinese schools and how it could be used for educational purposes. We, as a country, need to think really carefully about children's digital rights and strong evidence-based practice before we start putting these technologies in schools. I think we need to incubate them, do the research carefully, and actually come up with some pretty robust questions before we start to roll things out.

**The CHAIR**: In terms of the benefits, though—they are some of the negatives—but there are, obviously, benefits. You say yourself, you have the app that I went on to look at literacy and grammar. I only did the full stop, so I cannot talk about that too much. But what role do you see digital technology taking in keeping students engaged? We have talked about how it might be monitoring something and they are not engaged, but one of the big issues that we confront now is that kids or secondary students can leave the system—exit early or be disengaged. There is an expectation now that they will continue to year 12 or do something else. How can we give them alternatives and experiences that will actually enhance that engagement?

**Prof. SOUTHGATE**: Well, all students will have to deal with these technologies in everyday life—there is no doubt. AI is here. Immersive technologies will increase their foothold in our lives in different ways, very kind of boutique ways or niche ways, I suppose, in the future, and we should feel comfortable. We know, for instance, that children and adults game. Billions of people around the world game. And they game together. They learn collaboration skills, for instance, and they learn communication skills. There has been quite good research on building literacy competency through gaming, actually, particularly around second-language learning. So you can learn a second language while you game, because it is a great big multiplayer open world out there.

**The CHAIR**: Is that good for adults as well?

**Prof. SOUTHGATE**: Yes. So there is quite nice research on that. These technologies are here. I mean, the issue is how we can use them authentically in classrooms. Students and teachers want authentic learning. They want to know how it connects to the real world. They want to be able to do things that are creative and interesting. They want to harness their interests with the technology in the classroom. I mean, you still have to have mastery of content. You cannot have good learning without mastery of content, and you cannot have good learning without some didactic teaching, as well—you need didactic teaching. But it is really how we take these technologies and what they can offer

students that no other learning experience can. I would argue that with something like virtual reality, it can transport you to another place or time that you could not experience otherwise. I can go and experience the Kimberley in VR using Google Earth; I can fly in and have a look around. Let us face it—it is not as good as going there and meeting people and being able to talk, but I could fly in and I could meet one of you there, and you could take me on a guided tour. That may be something that I would never get to experience. Before I went to Paris this year for the first time, that is what I did—I flew in on Google Earth and I went and toured around Paris, I went in to a baguette shop, I flew up to the Eiffel Tower and I had a good look around the city. It was an amazing experience.

[11.20 am]

Historically, it can take you to places you would never go. You can go back in time and interact in huge historic virtual worlds. The thing about VR is that you can inhabit characters from different perspectives, so it gives you a perspective-taking process. It can take you to places that are too dangerous to go, where you could not go, like the edge of a volcano. Then you can watch the volcano erupt and then you can fly into the volcano and see what happens during the eruption. It can do that. There are certain types of virtual reality such as social virtual reality, where you can go into places where we could meet as avatars. We put our headsets on, we go in there, we meet. I could learn another language with a native speaker. In fact, this happens every day. I can go in and go on Let's Learn Spanish in a social VR space, and off I go; I can converse. Or I can go to a conference in VR. I have seen a New York theatre company do a play in VR. I have been standing in the living room while they are actually doing the play, and then I can interact with the actor and the director and ask them questions. I could never do that. I mean, I can do it on the screen, but when you are in the space and you are talking to them and you are moving around, it is a very different feeling.

Then there is the type of virtual reality which is kind of a sandbox, where you can create your own worlds. This is not just about being consumers, but creators and problem-solvers in this space. One of the research projects that I did used the sandbox Minecraft, which is a game that has a lot of engineering properties built into it, but there is a virtual reality version. The kids were quite confident with Minecraft on a screen, and then we put them into a VR version, and it has become something different again. You are not just looking at something flat on the screen; you are in the actual Minecraft world. You can jump on a horse and ride away, you can swim underwater with dolphins, you can fly to the clouds and jump down. What we got them to, in a very structured way, with the curriculum, as a formative assessment task, was to build a body organ. They were doing a biology unit. We asked them to do research in groups on a particular body organ of choice and to be able to educate others on that body organ by building a model—a 3D virtual model in Minecraft. We had very limited equipment—very new, high-end equipment that had not been put in classrooms before—and there are a lot of technical failures with the new equipment; you have to be quite resilient to keep going. In the end, for instance, one group of students decided to look at the human brain, so they produced a model of the human brain. Now, when you looked at it on the screen, it looked pretty impressive, but when you put the headset on, it was like a skyscraper. They built this enormous spinal column that went up to a brain, which they divided into two sections. One section was transparent, so you could see they had used the engineering properties of Minecraft to represent neurons firing, and they had lights representing thoughts, and they built the spinal column. If you kind of took a section off it, you could see the spinal fluid. And they annotated the model. So you are not only looking at a model on a page or on a flat screen; you could fly around it; you could interact with it. You could make things happen with the model. When they gave a guided tour in VR of their brain, they were narrating from memory what the functions of the brain were, what the different components of the brain were, and what the brain does in the body. They

had a very deep knowledge of the human brain, which went with the other knowledge that they had learnt in biology. So they saw it as an engaging task. They saw it as a task in which they got to show others what they had created and what they had learnt. These were students from a low-income school community who would never get access to this equipment generally. The sheer pride in those students' faces about their incredible models and allowing others to experience them, and allowing them to teach others about what they had learnt about different organs of the body, was a really amazing experience, I have to say.

It is really about students using these different virtual-reality applications, or other applications, for instance, creatively. It is about leveraging our existing curriculum to be able to do that. That is really engaging. They are learning not only technology skills, but also collaborative skills, communication skills, problem-solving skills and research skills. They have to master the knowledge. They have to be metacognitive. They have to be able to self-regulate their learning behaviour to do this, to work together to build a model like this. All these higher-order thinking skills and doing skills—soft skills—we put under the umbrella of deeper learning. It is about leveraging these technologies for that deeper learning. Of course, once you can master those competencies, you can take them anywhere and apply them to another problem or another thing that you need to learn, and that is what education should be about.

**Ms S.E. WINTON**: I just want to go a bit further with that. Being a former teacher, I see that fitting very well in lots of different contexts. Do you have any examples where that kind of technology is used for at-risk learners, or our high performers?

**Prof. SOUTHGATE**: The schools that I work at generally are low-income school communities, so 50 per cent of those kids will be in the bottom socioeconomic status quartile. Half of them are from the lowest quartile. Maybe one-third of them have not even got a device that they can bring to school. If you talk about at risk, I think, generally, in these types of schools' communities, a lot of these kids will be considered at risk, although I do not like to call them that. I like to call them resilient, amazing learners who just need an opportunity, really, to show what they can do, and maybe this technology can hook them in to do that. What we did see, interestingly, in some of those classes were children with special needs—so, children with Asperger's, for instance—who became the hero in the class. Technically, for instance, some of those children were very, very competent in Minecraft, and in Minecraft VR they were more than competent. They were showing the other students what was possible, actually, and what to do and how to have fun in it, as well as learn in it. It is combining fun and engagement with learning. So they became kind of the heroes. In other studies that I have done, it is often the quietest students, the students who do not talk very much, who are not shining in the class who can, when they, for instance, go in to VR to create—because you are creating and you are doing and you do not have to speak all the time, but you can show what you can do in there—they really shine and they come to the fore, because they can create, they can do, and they might not be the most verbally confident or competent students, but they certainly are when they create. So they become the heroes of the group, for instance—those sorts of students. That example I gave with the Minecraft project, there was one student in that group who did an amazing job—incredible scientific understanding of the engineering properties of Minecraft but also of the biology they were studying. I was just standing there and he was talking about what he had learnt and the teacher said, "I haven't heard you talk in three years. I haven't heard you say a word in science in three years and look at you now." He was absolutely thrilled to be achieving in science through this kind of medium. This is a student who everyone thought would leave school early. I actually said, "That student needs to go and study engineering at TAFE or university; they're more than capable, actually, of studying engineering or some sort of science." Because it is experiential learning, because it is about doing and creating, not just consuming—if

you use it properly, it should be about doing things in it and creating—it is often the students who like to do things that shine with the technology, and their knowledge will grow from that, rather than just having kind of very didactic, passive learning which is teacher delivered, for instance. Those other students, when they can get in and create and do things, really do shine.

**Ms S.E. WINTON**: Do you have any views on gender differences?

**Prof. SOUTHGATE**: There are big gender differences around technology use in general.

**Ms S.E. WINTON**: Yes.

[11.30 am]

**Prof. SOUTHGATE**: One of the problems we have in this country and many western countries is that we have a lack of diversity in our tech industries. Despite years of trying to encourage girls, for instance, to do computer science, the numbers of females entering computer science degrees in this country is stagnant. It sits at around, from memory, between about 13 and 15 per cent, and they have not been able to shift it for years. If you walk into a computer science class in any university, it is all men. It is a real problem, because unless we have diversity in our tech industry, we will not have diversity in design and we can have bias —

**Ms S.E. WINTON**: Yes; that is what I was going to suggest. The material that is in schools is very —

**Prof. SOUTHGATE**: Or we have unintended bias built into applications such as machine learning applications, artificial intelligence applications, for instance, that rely on training sets. The training set can be biased, but because, for instance, the engineers are men, they will not recognise that the bias is gendered, for instance, or there is a bias in terms of ethnicity or ableism or other issues. There is an issue in this country. I think we have tried to solve it by tacking programs on—very good programs—as extracurricular activities. Lots of women are in tech programs where you will take girls out of school and give them a workshop or a course, or an engineer will come into school and run a workshop or two, or a semester maybe, but it is not enough. We need a systematic approach to really thinking about gender and technology and learning in this country and to grapple with it at a serious level. To do that, you will need all teachers involved, and particularly women teachers, standing up, using technology in class and running technology classes and we will need to encourage girls in different ways through the design of the curriculum to do that. In the VR class, there are a lot of girls that do not want to put the headset on. It is embarrassing. It is ugly. The newer headsets sometimes have a camera you can switch on and see through so you can look around the room, but generally you cannot do that with a VR headset; you do not know who is looking at you. That is a huge gender issue for girls and for women, because we are trained from very young ages to be aware of our surroundings for our safety and to be really conscious about what we look like in public space. So these kinds of headsets are really problematic. It is like a gendered blindfold—the virtual reality headset. There are some engineering solutions coming in, like these see-through cameras where you can switch through and look around, but, in general, girls are reluctant until you can get them in and give them a go and that bit of confidence. But it really does take a particular approach.

I know in the Higher School Certificate in New South Wales, I think that it was around 10 per cent of girls—it might be a little bit more—did software engineering for their HSC last year. We are in real dire straits with this issue, I have to say. It would be nice to have a national approach to it which was not just about an events-based approach or a workshop based approach, but was really embedded in the school and the school curriculum and what schools can do.

**The CHAIR**: Josie, did you want to ask any questions, because we will have to wrap up soon? Did you want to ask about delivery into Indigenous communities?

**Ms J. FARRER**: I find that with some of our Aboriginal kids, they find learning in the western system a bit daunting for them, but also they struggle with it. I find that there are some kids that have this gift that they can see things, do things, and they are in tune with that. When you were talking about some of those things, it fitted in with how I see the kids. But it is not only that; they have been born with a lot of this sort of intelligence. I think that has been stemmed through western education, because they have not been able to express or to say those things or do things. I believe that some of our children should be assessed because they have a lot of this intelligence that is in them—they are born with it—but they do not really know how to express it or to show it. We talk about IQs. Some of these kids can go beyond that. This is why I am saying that it is Indigenous people; you can see these things. I guess it is just the way, because they have been able to survive for 70 000 years; they have that mechanism that is already instilled in there.

**Ms S.E. WINTON**: Do you see some of the stuff that Erica was describing being suitable to Aboriginal kids in terms of taking themselves off to different places and finding that as a useful way?

**Ms J. FARRER**: I think it is very useful because it can bring out, I guess, a lot of the things that they know and understand that is built in. You talk about seeing things. Sometimes when you are doing things, it is like you are in a third dimension—those sorts of things.

**Prof. SOUTHGATE**: Yes.

**Ms J. FARRER**: There has to be some way. With education, this has to brought out and identified, because there are a lot of kids that have that, but I think the blockage is because we are teaching them under a different set of curricula. The way that our kids are being taught now, it sort of blocks or prevents a lot of them from learning, because what they have been born with and understand and what they have to learn through western learning and the curriculum seems to prop up some sort of, I guess, bridge. When the kids go to school, they do not want to learn about the western system and the curriculum that is there. This is why they say it is so boring. But if you get them out in the field, they are very much in tune with the environment, with everything that is going on around them. So there has to be a way we can bridge those two together, I believe.

**Prof. SOUTHGATE**: Yes, I think doing and seeing and creating is all about that, and then having people experience that. There is a really great young scholar called Rhett Loban who is from Macquarie University. He is a Torres Strait Islander man who has told Torres Strait Islander stories in VR and developed that through community consultation. He talks about that, actually, so he might be someone you might be interested in talking to. He is in education, but he is also an Indigenous VR developer. His work is just lovely, and he really has great insight into how virtual reality might fit with Indigenous cultures.

**The CHAIR**: Excellent. Yes, we will follow him up; thank you for that. My last question—we are due in Parliament at 12 noon so we will wrap up in the next five minutes. DART Connections is a New South Wales government site—I am not sure if you are aware of it, but you probably are—organises virtual excursions for schools. Are you aware of anything similar in other states?

**Prof. SOUTHGATE**: Yes. Virtual excursions are a big thing with VR. Virtual excursions—virtual field trips, we call them—are one of the first uses of virtual reality for education. You can go there, navigate around, have a look at stuff and come back. Sometimes, they have built-in assessment in the virtual field trip, but often you will come back out and do an assessment. That can be really great for starting a lesson, or as additional media for a lesson, sort of enrichment for a lesson, but, you know, I think we can do much more with the technology than just sit there and consume it. I think, for lots of learners, the creation and the doing and the seeing and the sharing is what is exciting—not just sitting there taking it in, in a more passive way. Although there is certainly a place for that within curriculum, but that is the lower hanging fruit.

**The CHAIR**: Thank you very much. That was exceptional. We started out the meeting this morning with me saying I feel like we are not going to get anything from doing this inquiry, but now you have reinvigorated me to think that there are great possibilities in terms of how we can look at and contribute to the debate for our departments and also with our parliamentary colleagues about having a knowledge and learning about how this can apply to our schools and most particularly to our students. Thank you very much. Did you want to add anything at all?

**Prof. SOUTHGATE**: I would just say that teachers and school leaders need to be part of building the evidence base for this. We cannot leave it to universities and we cannot leave it to big technology companies. We need teachers involved. It is always a tough ask, I know, but we will get much better evidence for how to use the technology in classrooms if we involve them.

**The CHAIR**: Thank you very much. We really appreciate you giving evidence today.

**Prof. SOUTHGATE**: Thank you. Thanks for having me.

**The CHAIR**: We will send you a transcript, and you can just check that and get back to us, then it becomes public subsequently. Thank you so much.

**Prof. SOUTHGATE**: Thank you so much.

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**Hearing concluded at 11.40 am**

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