Education and Skills Committee

Wednesday 12 June 2019

The Scottish Parliament
Pàrlamaid na h-Alba

Wednesday 12 June 2019

CONTENTS

EDUCATION AND SKILLS COMMITTEE
20th Meeting 2019, Session 5

CONVENER

*Clare Adamson (Motherwell and Wishaw) (SNP)

DEPUTY CONVENER

*Johann Lamont (Glasgow) (Lab)

COMMITTEE MEMBERS

*Dr Alasdair Allan (Na h-Eileanan an Iar) (SNP)
*Jenny Gilruth (Mid Fife and Glenrothes) (SNP)
*Iain Gray (East Lothian) (Lab)
*Ross Greer (West Scotland) (Green)
*Gordon MacDonald (Edinburgh Pentlands) (SNP)
*Rona Mackay (Strathkelvin and Bearsden) (SNP)
*Oliver Mundell (Dumfriesshire) (Con)
Tavish Scott (Shetland Islands) (LD)
*Liz Smith (Mid Scotland and Fife) (Con)

*attended

THE FOLLOWING ALSO PARTICIPATED:

Shona Birrell
Lorna Hay
Alastair MacGregor (Scottish Schools Education Research Centre)
Dr Karen Petrie (British Computing Society)
Professor Lesley Yellowlees (Learned Societies Group on Scottish STEM Education)

CLERK TO THE COMMITTEE

Roz Thomson

LOCATION

The Robert Burns Room (CR1)

Scottish Parliament

Education and Skills Committee

Wednesday 12 June 2019

[The Convener opened the meeting at 10:00]

Decisions on Taking Business in Private

The Convener (Clare Adamson): Good morning, and a warm welcome to the 20th meeting in 2019 of the Education and Skills Committee. I remind everyone present to turn off mobile phones and other devices for the duration of the meeting. We have received apologies from Tavish Scott.

Agenda item 1 is a decision on whether to take consideration of a draft report on subject choices in private at future meetings. Is the committee content to do that?

Members *indicated agreement.*

The Convener: Thank you. Item 2 is a decision on whether to take consideration of our work programme in private on 26 June. Is the committee content to do that?

Members *indicated agreement.*

Subordinate Legislation

Education (Scotland) Act 1980 (Modification) Regulations 2019 (SSI 2019/179)

Abertay University (Scotland) Order of Council 2019 (SSI 2019/163)

10:00

The Convener: The next item is consideration of two pieces of subordinate legislation. Details of the instruments are provided in papers 1 and 2. Do members have any comments on the instruments?

Members: No.

The Convener: Thank you. That completes item 3.

Science, Technology, Engineering and Mathematics Inquiry

10:01

The Convener: As we move on to item 4, I declare interests as vice-chair of the Scottish Schools Education Research Centre and a member of the British Computer Society.

This item is an evidence-taking session for our inquiry into science, technology, engineering and mathematics in early years education. I thank all those who helped to arrange the primary education conference that took place last week. That included organising a really insightful visit to inform committee members, and I thank the Primary Science Teaching Trust for that opportunity. We thoroughly engaged with the young people and teachers whom we met during the children's conference and at the awards ceremony on Thursday night, and it was inspiring to see the brilliant work that is being done by teachers across the whole of the United Kingdom.

I welcome to the committee Shona Birrell, who is a teacher at Ratho primary school; Lorna Hay, who is a teacher at Pitteuchar East primary school; Alastair MacGregor, who is chief executive officer of the Scottish Schools Education Research Centre; Dr Karen Petrie, who is associate dean for learning and teaching in science and engineering at the University of Dundee and is today representing the British Computer Society; and Professor Lesley Yellowlees, who is chair of the learned societies group on Scottish STEM education.

We have a big panel today, so you should not feel that you all need to answer every question. It would be helpful if you could not answer questions for the sake of it. However, when you have something insightful to say in response to a question, we will, of course, be delighted to hear it. Will you start by saying a little about your experience in relation to STEM in early years education? We will start with Dr Petrie.

Dr Karen Petrie (British Computing Society): I am a computing lecturer when I am not being associate dean for learning and teaching, and I do quite a lot of work with primary schools both locally and throughout Scotland, particularly to help them to deliver the computing science and digital skills parts of the education remit. I have helped to organise a number of events to help with continuous professional development for teachers in that context.

Before I came here today, I asked a lot of the local schools that I work with, "What's the one

thing you would like me to take to the inquiry?" I thought that I would start there. The main thing that came back, quite surprisingly, was that what has helped them the most to deliver the curriculum is a working internet connection.

The Convener: Really?

Dr Petrie: That surprised me, but four separate schools—and there were some tweets this morning—said that that is the biggest barrier and that, on any given day, they cannot trust the connection to be there. It is difficult to use a lot of digital skills and undertake the technology teaching—a lot of which is online, as I am sure the committee knows—if there is no working internet connection. I thought that I would start there.

The Convener: Was that evidence geographically based?

Dr Petrie: All of those schools are in Dundee, but we were talking earlier and realised that the issue is more widespread than that.

The Convener: Is it because there is a rural element to those wi-fi connections?

Dr Petrie: No—one of the schools is in central Dundee, so you would not expect it to have internet issues.

Alastair MacGregor (Scottish Schools Education Research Centre): I am the chief executive officer at SSERC, and I have been in post for just over a year and a half. During that time, the organisation has been through a significant amount of organisational change and some diversification. Part of the diversification is intended to broaden our offering to include early years practitioners and, now, childminders.

SSERC has three core functions in supporting STEM education across early years practitioners, primary and secondary school teachers and school technicians. The first is career-long professional learning. Whether that is through twilight, half-day or full-day sessions, our unique selling point is the offer of practical, hands-on experiential learning that is backed up by the appropriate level of pedagogy to support that.

Our second function concerns health and safety in supporting the educational community in Scotland. Health and safety can sometimes appear to be rather bureaucratic and may be part of the reason why practical STEM-based activities are not undertaken in the classroom. We provide commonsense advice to the teaching profession to make sure that that does not become a barrier.

Thirdly, in relation to inspiration, we have responsibility for wider STEM engagement projects such as the ambassador programme, teacher placements and the young STEM leader

programme. In all those projects, we have interactions with early years practitioners.

Professor Lesley Yellowlees (Learned Societies Group on Scottish STEM Education): I am here to represent the learned societies group, which is based at the Royal Society of Edinburgh. I chair the group. It was set up in 2012 to bring together learned societies to agree common ways forward and suggestions, forming a portal for the Scottish Government, so that lots of groups and organisations such as the General Teaching Council for Scotland can work together through us.

I will read off the names of the learned societies so that I do not miss any. They are the Association for Science Education, the British Computer Society, the Edinburgh Mathematical Society, the Institute of Physics, the Royal Society of Biology, the Royal Society of Chemistry, the Royal Society of Edinburgh and the Scottish Mathematical Council. You can see that we cover most of the STEM subjects.

Having read the *Official Report* of your previous meeting, I will say that I was the chair for the "Tapping all our Talents" report and I am happy to answer any questions you might want to ask about that. I also chair the STEM strategy equality sub-group, which was established by the Scottish Government. I have several hats on, should any of them be appropriate for today.

The Convener: Thank you. I welcome Ms Hay back to the committee.

Lorna Hay: I have met some of you before. I am a primary school teacher in Pitteuchar, in Glenrothes, with a particular interest in engineering. I completed a postgraduate certificate in engineering STEM learning and will reiterate a lot of what I said before. My research found a lack of confidence in schools in that aspect of STEM. I have spoken before about not bundling STEM as one thing but looking at the discrete parts and finding that technology and engineering are where there is a lack of confidence.

In our school, we have worked hard to increase the visibility of engineering. We are a pilot for the institution of primary engineers, which is a whole-school approach to developing security-mindedness, STEM and employability skills in primary-age children. We are developing that and trying to embed STEM in what we do. In the short time that we have had so far, we have seen the confidence among staff begin to increase.

Shona Birrell: I am a primary teacher with the City of Edinburgh Council. I currently teach primary 4, but most of my experience has been in the early years setting—nursery and primary 1—and I hope that I will be able to describe some of my experience from those years. I am also a parent of two children who are at nursery, so I am

here not only as a teacher but as a parent, and I hope that I can share some knowledge from that side as well.

The Convener: I thank the witnesses for their submissions, which were helpful, and I open up the meeting to questions.

Iain Gray (East Lothian) (Lab): In the inquiry, we have heard a lot of examples of good practice, good initiatives and impressive work that is under way, but that seems to be driven largely by the interests and passion of particular people in particular places. Indeed, a lot of our witnesses have been those people, as you would expect. How can we mainstream that work so that children's and young people's experience of STEM does not depend on the good luck of having someone available who has an engineering passion or whatever? How can we make that work central to our education system?

Lorna Hay: We need to cascade knowledge and build capacity. In my school, we are trying to build capacity in the rest of the staff. The headteacher has recognised that I and another teacher have that particular passion and has thought about what would happen if we suddenly went elsewhere. In the current session, we are trying to build capacity, and I will be funded partly to work with other staff. That will involve team teaching and, I hope, will build their confidence to the same level. Any opportunities that teachers can have to work collegiately and to share their knowledge should be taken, because there is a lack of confidence among other people.

I have read all the submissions, and it seems that there are excellent opportunities to get funding. The leadership and collegiate professional learning fund can be used to pay for supply cover so that teachers can be released to work with others who have more experience. Money is not an issue; the issue is actually the bodies. My headteacher has said that it is not a problem to find the money to provide cover for me but that they cannot physically get a supply teacher. There is a bigger issue about how we address the shortage of supply teachers. It is all well and good to say that money is available to fund teachers to be released from class, but that is irrelevant if you cannot get in supply teachers to cover. We need a bank of supply teachers to go into schools and release staff, who can then cascade their knowledge so that all schools get the same access. I spoke about that on the phone with Shona Birrell, and we agreed that it is an issue, although I do not know what the other witnesses' perspective is.

My mum is a teacher, and we lived in Gateshead for many years. I remember that, at one point when she first started, she worked for the local council as a permanent supply teacher.

There was a team of such teachers who were based at a centre, and their job was to go into schools to provide cover when other teachers needed to come into the centre for training or whatever. The council there at the time put a lot of money into that. Perhaps that is a solution. We could entice more people into supply teaching and have a permanent bank of teachers who could go out to work in schools.

Unfortunately, in Fife, our teacher centre was knocked down a few years ago, so I do not know where such teachers would be based, but my perspective is that we need to enable teachers who are confident to work with other teachers to develop their confidence.

10:15

Professor Yellowlees: What has been said is absolutely correct. Cluster teaching is vital, because we need to look for specialists who can help out. That is an immediate way forward. I am sure that Alastair MacGregor will say something about CLPL from SSERC's point of view, because I think that a body has been set up to help with such learning. Some of the things that we have talked about relate to the short term, so please do not leave your schools.

Lorna Hay: Oh no—I do not intend to.

Professor Yellowlees: It is important to recognise where there is strength, to build on and celebrate that strength and to share good practice.

We can also look at the long term. We should ensure that everyone who goes into primary school teaching has some sort of science qualification from school. For example, we could ensure that everyone has at least one level 5 qualification, so that they have some confidence in science as a whole. We might then raise the bar by requiring two or three qualifications. At the moment, a significant number of primary school teachers enter initial teacher education with absolutely no science background at all, and people who have no science background at all will start from a very low baseline. How can teachers inspire our young people to take up science and engineering if they themselves have not been inspired?

We need a long-term plan to ensure that all our primary school teachers are comfortable teaching science and have an experience of science. It is not only about the science; the pedagogy of teaching science, how we think scientifically, how we look at and interpret data and how we problem solve are all crucial. We should have a long-term plan and a short-term plan.

Dr Alasdair Allan (Na h-Eileanan an Iar) (SNP): You have talked about entrance

qualifications for teaching. Do universities have a role in providing training to people who are hoping to go into initial teacher education but who do not have a science background?

Professor Yellowlees: Absolutely. I am a firm believer in that. Whether people come into initial teacher education as a graduate or straight from school or college, there is work to be done in ensuring that the curriculum is properly developed to give teachers the confidence—it comes back to confidence—to engage with pupils and deliver the teaching.

I firmly believe that there is work to be done across the board. I have highlighted one area, and Alasdair Allan has highlighted another. CLPL is another area that we could highlight. Lots of different things could be done, but a degree of direction needs to be given.

Jenny Gilruth (Mid Fife and Glenrothes) (SNP): I want to ask the practitioners about Professor Yellowlees's point about qualifications. As we heard at last week's meeting, there is a challenge, in that our primary teachers are meant to be generalists, whereas our secondary teachers are subject specialists. I trained as a modern studies teacher and would love every primary teacher to have a higher in modern studies, but, practically, that is not realistic. Under the broad general education, everyone who comes into the profession should have been exposed to science and technology teaching at least until the end of secondary 3. Do the practitioners agree that there should be a requirement on primary teachers to have a national 5 qualification in science or technology?

Lorna Hay: When the issue was raised previously, I said that I would be hesitant about introducing such a requirement being introduced, because there are already barriers to getting people to become teachers, and adding another barrier might restrict the numbers. However, I acknowledge that we need to do something, so we could look at teachers being able to do further training while they are on the course. I would be hesitant about creating more barriers when we need more people to enter the profession.

Shona Birrell: Yes, it is useful for primary teachers to have a national 5 in a science or computing subject, but there is also scope for working more collegiately with our secondary colleagues and looking to industry for links to expertise and training, so that teachers in schools have access to people who have the knowledge, skill and resources to support us to teach our youngsters.

Alastair MacGregor: I concur with what my colleagues have said. I will touch on three things that have been said.

The first is teacher self-confidence. It is important that teachers have sufficient self-confidence to go into the classroom and actively participate in STEM-based activities. However, it is not just about self-confidence. Teachers can be self-confident, but if they do not have the underpinning knowledge and skills to support that level of confidence, our learners will be disadvantaged. The confidence and competence need to go hand in hand.

There is an opportunity linked to teacher training. We are currently having dialogue with some of the ITE institutions in Scotland in relation to digital skills. We talked to a university whose digital skills programme is fully integrated into its primary ITE, but we talked to another ITE institution that has a one-and-a-half-hour session. We want to work with the ITE institutions to provide the required level of digital support. On our journey as an organisation, we are looking to become a credit-rating body. We would have a natural role working alongside ITE institutions to provide a masters-level qualification to support primary teachers who are coming into the teaching profession.

I am an optimist and I think that there are opportunities for us. There are opportunities from the Scottish Government's STEM strategy. That could be a hook for local authorities and, in particular, our regional improvement collaboratives. Primary teachers who come into SSERC to undertake professional learning say to us that, if STEM is not in the school's improvement plan, it will go nowhere. Education Scotland's recent recruitment of STEM advisers is an opportunity to have that resource as a positive tool to ensure that STEM appears in the plan. There is always a perception that, if STEM does not appear in a school's improvement plan but literacy and numeracy do, the school cannot do STEM. We say that it can use STEM as a vehicle for taking forward that literacy and numeracy.

I like to be positive. I think that there is an opportunity. The Education Scotland regional advisers are just in post and there is an opportunity for us to engage positively with them to make sure that the message is being spread.

Dr Petrie: There is another way to look at this. Do all primary school teachers have to be science and technology specialists, or do we change the primary school model slightly to have one or two science and technology specialists in each school, who deliver that teaching and upskill the other primary school teachers? I have seen that model work. Fintry primary school near us has hired somebody mainly to teach computing. She does some other teaching as well but she is a computing specialist. Fintry is a big primary school, but that has worked well for it and, due to

that model, it is now a digitally literate STEM school.

We might be asking too much of primary school teachers if we ask them to be specialists in everything and to teach everything to the same level. Perhaps a new model is required.

Alastair MacGregor: That links to what Lesley Yellowlees was talking about in relation to the cluster-based model. For SSERC, through its primary cluster programme, and the Wood Foundation and Education Scotland, through the RAiSE programme, it is not about making every teacher a STEM specialist. It is about saying that we should take some key devoted primary teachers and early years practitioners such as Shona Birrell and Lorna Hay and provide them with enhanced mentoring and leadership skills. Let us provide them with additional, practical, hands-on, experiential types of professional learning and they can then go back into their school and work with their peers and learners. They can go back into their local authority and cascade that CPD in that way. That does not mean that everyone has to be a specialist. It is a cascade model.

We have piloted a primary cluster programme for the past six years. It is independently evaluated, and it has been said that it works and that there are highly motivated mentors. Those mentors have developed their own pedagogic and assessment skills and have promoted science and technology activities in classrooms across the region.

Therefore, there are models. We need to build on the models that have a proven track record of working.

Lorna Hay: I want to add to those points. In our school, STEM has primarily been delivered by my colleague Laura Peden for the past three years as part of our non-class contact agreement. The rest of the staff agreed that they wanted her to teach STEM during the time that she had the children. That has been done for around three years, but next year she will be back in class. There was a fear that, if she is back in her own class, the rest of the learners who have had weekly access to STEM activities for several years will suddenly not have that access, which is why we are building capacity among the staff.

I do not necessarily think that a single specialist in a primary school to do all the teaching to all the learners is the right answer because, if they suddenly leave, none of the rest of the staff will have the capacity to deliver that teaching. Laura Peden and I will mentor other staff so that they will still deliver those experiences. Having a specialist who does only that work, as there are in high schools, is not the best situation. All teachers need to give their learners opportunities. If you do not

do it, you lose it. If we are not teaching STEM, confidence and competence will never grow.

Iain Gray: That is all really helpful.

I would like a point to be clarified. The point about the national improvement framework is important. We received evidence on that from Education Scotland and the Scottish Government last week. Their point was that STEM is not part of the national improvement framework in the way that literacy, numeracy and wellbeing are. I think that Alastair MacGregor in particular spoke about that. Are you saying that, as long as that is the case, all the efforts that you have described may come to naught? That is an exaggeration; rather, will there be an uphill struggle because schools will see that their required focus should be much more on literacy, numeracy and wellbeing? Is that fair?

Alastair MacGregor: There is perhaps some anecdotal evidence to support that assertion.

Dr Petrie: I have some quite interesting anecdotal evidence. On a Saturday around four weeks ago, we had the Tayside regional improvement collaborative digifest in Dundee, which is a CPD event for primary school teachers, mainly teaching computing skills. More than 100 schoolteachers showed up at that event, unpaid on their day off, which shows the willingness that there is to teach and learn in these areas. That was really good.

One of the teachers at that event stood up and said that she does not currently deliver to her class intended learning outcomes in computing science at all. She said that she thought that she could get away with that, because nobody will ever inspect those ILOs for computing science. That surprised me. She did not say that that was fine; she was there to learn how to do it, and she wanted to do it, but she had not delivered for a number of years, and she thought that nobody would ever pick up on that as an issue. I wonder how true that is throughout our schools.

Liz Smith (Mid Scotland and Fife) (Con): Professor Yellowlees, I am very interested in the issue of staffing. You will recall that, at the 2016 festival that the Royal Society of Chemistry held at Dynamic Earth, it made the specific call that it would like there to be a specialist scientist in every primary school. Do you feel that that was the right call, given that some of your colleagues and some of our previous witnesses have said that that is not necessary, if we can ensure that there is team teaching and a cluster approach, or do you think that that would just be a nice additional thing that would be helpful to science if it were possible?

10:30

Professor Yellowlees: We would all agree that it would be nice if it were possible—given that you can have a specialist subject in lots of different areas, why would you not have that? As an ultimate goal, what is not to like about it? However, the question of it being a realistic goal is a different matter.

I am trying to speak on behalf of all the learned societies. Although I have a special affiliation with the Royal Society of Chemistry, I am trying to step back from that. I believe that all the learned societies are great fans of cluster teaching. With cluster teaching, various people can come in at different times; if you can get various specialist teachers, you can cover much more of science, technology, engineering and maths than you would if you just had one teacher. One specialist—by their very nature—cannot cover all of science and technology. It is much better to go down the cluster route and have various teachers coming into schools for a day at a time, and perhaps doing that for a term before going elsewhere. What I do not like is single interventions. That has been proven not to work. It is very attractive to groups, because arranging a single intervention makes them feel that they have done something. However, have they made a lasting difference? No. We have to go away from that approach. I withdraw slightly from what the Royal Society of Chemistry advocated three years ago.

Liz Smith: Mr MacGregor, that ties in with an interesting point that you made about the fact that, even if you have all the confidence in the world, you will not get very far if you do not have the necessary knowledge and specific science training. What discussions have you had with the universities? You mentioned that one had perhaps not progressed as much as the others. What discussions have you had with the GTCS about promoting more of that specialist knowledge and, therefore, ensuring that there is a greater lead-in that will create an affinity with the science subjects, which, obviously, promotes greater confidence and ensures that people enjoy teaching them?

Alastair MacGregor: In our organisation, we have an advisory governance structure and a professional development advisory board, on which sit representatives from the ITE sector, Education Scotland, the Scottish Government, the GTCS and others. We have floated the idea of SSERC working in partnership to provide a certificated programme for practitioners that is based on developing the level of competence that is required to undertake not only science but STEM-based activities. It is probably going to take us a significant period of time to move that forward.

Liz Smith: I am interested in that comment. With regard to those who would like to come into the teaching profession as STEM experts, is the issue that they do not have the necessary knowledge and background from their university degrees and experience in other education institutions, or is it that they are not sufficiently confident and competent when it comes to disseminating that knowledge via their teaching skills in the classroom? Those are two different things.

Alastair MacGregor: I think that the issue is probably a combination of both things.

Liz Smith: Is somebody trying to work through this problem?

Alastair MacGregor: It is an on-going discussion that we continue to have with the ITE institutions and the GTCS. They see the benefit of that type of opportunity, but it will be a challenge to move that forward in a timely manner.

Liz Smith: Why? We want to see this issue progress—that is why we are conducting this inquiry. If there is some block in the system that is not allowing you to further those ideas and ensure that those who are becoming science teachers are of the highest order, we would like to know what it is. It seems that you are reluctant to say.

Alastair MacGregor: It perhaps comes down to the view that there is not sufficient time in a postgrad primary teacher's timetable to allow that to take place. We have suggestions that we can make in relation to twilight sessions, summer school sessions and online activities to support that and, as I said, discussions are at an early stage. Like you, however, I would like that to be fast tracked.

Liz Smith: Professor Yellowlees, do you agree that we need to work on that to ensure that universities and other educational institutions are developing those points?

Professor Yellowlees: Absolutely. There are many providers of ITE in Scotland, and if we want to improve the lot of all our children at school, we have to do it across the board and ensure that everybody has bought into it and is doing it. Otherwise, we will still get disparity of experience for children, which is what we do not want.

Ross Greer (West Scotland) (Green): I want to return to the points that were made about CPD, and specifically to what Alastair MacGregor said about the early years in his opening remarks.

In our previous evidence-taking session in our inquiry, we heard some interesting evidence on the tension that perhaps exists in giving early years practitioners—not nursery teachers, but the rest of the early years workforce—the required CPD opportunities in STEM, given that there is a

much higher turnover in that workforce than there is in the teaching workforce. A concern was raised with us that management and local authorities are reluctant to spend money on a workforce that has such a high turnover. Have you detected or experienced that? What is your understanding of how much access those early years practitioners are getting?

Alastair MacGregor: This is a new area for SSERC, as we have focused on the early years only in the past year. We have some specific early years interventions that we offer, and we want to continue to progress with that. However, I can speak only from where we are at present with our early attempts to provide support for that education community.

Shona Birrell: My background is as a nursery teacher, and many of the early years practitioners I have worked with have undergone training on the forest kindergarten model and STEM. However, there were then barriers to them being able to undertake relevant activities, such as the short nursery hours. If they had only three hours and 10 minutes, they found that, by the time the children were on the minibus and ready to go, it was time to come back. Other barriers were the staff to children ratios and funding for minibuses. The issue might be not high staff turnover but how staff can deliver activities with those barriers in the way. I am not saying that that is the case across the board—that is just anecdotal evidence from my experience. There are quite a few barriers to things being addressed, but high staff turnover might not be one of them.

Ross Greer: Was the local authority trying to work with nurseries to address that, or were the barriers not quite filtering back up to a level where support could be brought in to address them?

Shona Birrell: They were not being addressed, as far as I know. I think that people were saying, "These are the hours that the children have to do and you have to make it work, so don't undertake these activities—try to find something else in your setting." The children were missing out on the forest kindergarten experience.

Alastair MacGregor: That is linked to the two things that Liz Smith mentioned. We now work with early years practitioners and the childminding education community where there are issues with people being released to do face-to-face professional learning because that involves their being taken away from their teaching or practitioner duties. We operate an online platform that provides twilight sessions. It is about providing face-to-face professional learning to support an understanding of STEM based on practical activities, but doing it through digital technology.

We will broadcast live from our broadcast studios in Dunfermline out to, potentially, 45 to 50 schools where there are a variety of types of practitioners. We send out boxes of resources in advance, and we basically do a cook-along. We say, "Here are the resources and here are the activities. We will show you what you can do with these resources and we will also share the underpinning knowledge—the scientific or STEM basis and the concepts and principles." That seems to work because it is a short intervention of usually an hour to an hour and a half maximum.

Next week, we are having a discussion with one local authority that wants to work in partnership with SSERC to put in place a primary cluster type programme, which focuses specifically on the transition between nursery and primary 1. I hope that we will work in partnership to see what that looks like.

We have talked about cluster models, but they will work only if there is a legacy in place to make sure that it is sustainable. That is the beauty of the programme that we have piloted in the past six years. It has proved that there is a legacy and so, when there is staff churn and movement, it does not mean that the programme stops. There is a roll-out of career-long professional learning that is bespoke to the local community and it is still there; it is the legacy, which is important.

Ross Greer: Are you working with local authority and private sector early years practitioners, or is it just local authorities for now?

Alastair MacGregor: At the moment, because of our funding regime, we are working with local authorities.

Ross Greer: Do you expect there to be an appetite for this in the private sector? Have you had any contact with folk in the private sector?

Alastair MacGregor: Yes. There is a massive appetite for doing it. However, the funding of our organisation comes, in many circumstances, from the public purse either through the Scottish Government or through local authorities that are members of our organisation, so our focus has been primarily on working with the state sector.

Ross Greer: My final question moves away from early years and back to primary and the understanding of local authorities. Do you believe that local authorities have a depth of understanding about staff's need for CPD in the specific subjects in STEM, or do they think of STEM as the priority as if it is one umbrella term and that staff require training in STEM, whatever they might understand that to be?

Alastair MacGregor: That might vary between local authorities. I know of one local authority that put a blanket ban on anybody travelling to any

form of professional learning outwith that local authority, which is a significant disadvantage.

We keep talking about STEM. I suppose, because the term is used so much, it has a degree of visibility, but I wonder whether, when we talk to young people about STEM, there is a barrier to access. When we talk about scientists or engineering, we get a look of fear. We have primary practitioners coming to us, and we do science-based professional learning with them, but we do not take them into labs or get them to wear white coats; we do it in a standard classroom scenario because that breaks down the barriers and perceptions about STEM.

When we talk about STEM, I do not think of it as science, technology, engineering and mathematics; I see it as a collection of transferable skills within the context of science or technology. It is about the promotion of the skills that STEM subjects can give people. That is more important than the silos of science and technology, engineering and mathematics.

Professor Yellowlees: The word "STEM" was useful initially because it brought together a lot of the pedagogy and discipline of undertaking science. It translates to social science. It is not limited to that, but people now think of STEM as being everything. When STEM means interdisciplinarity across science, technology, engineering and maths, it is working well. When people think of it as a single subject, it is not working well.

10:45

STEM should be helping our young people to gain skills and to be able to use them; that then makes them highly employable, which is great. The earlier we start, the better, because then they will not be frightened. I feel so sad when people say that they are frightened of engineering or science. Why would they be frightened of it? It is really exciting.

At the moment, our lives are very much underpinned by what science and engineering can deliver. I want our young people to be excited by that, to be positively engaged with it and to take it up. I do not want them to stand back and say, "This isn't for me." It is for everyone and it should be for everyone. That is the message that we have to get across. If you want to extend that, you have to get that message across to the parents as well because they have to understand that science is for everybody.

Alastair MacGregor: To return to Ross Greer's point about local authorities' perspectives, the SSERC is a member-based organisation so we are funded by every local authority. Certainly, we are the first port of call for local authorities that are looking for STEM-based, practical, hands-on experience for professional learners.

Local authorities know that there is at least one mechanism there for them but there continues to be that issue that our practitioners have talked about, which is about getting the opportunity to be released to attend these types of intervention. As an organisation, we have to think about how we respond to that issue. We offer a lot of practical activities and practical professional learning within our organisation in Dunfermline, but we now go out to do more local interventions as well, because we realise that there are issues with releasing staff.

The Convener: I was undertaking an event on Saturday with the cadet organisations in Scotland on behalf of the committee and one of the people I spoke to said that they did STEM by stealth. When they do the engineering work and so on, everybody is engaged, but as soon as they brand it as being anything to do with STEM, people get frightened. I offer that as anecdotal evidence.

Oliver Mundell (Dumfriesshire) (Con): I want to return to Alastair MacGregor's response to Ross Greer's questions. In my local authority, according to the Scottish Government's figures, almost 40 per cent of early learning and childcare will have to be delivered by the private, voluntary and independent sector. Is there a case for looking at how we fund support for those groups? Obviously, that will create an inequity for the young people who are accessing Government-funded provision that is being offered by others.

Alastair MacGregor: There is an opportunity, but it comes at a cost. As an organisation, we can do more to offer support but we are probably at a tipping point regarding the level of professional learning that we can offer. Last year, we were funded to undertake 5,200 CPD units across the education community in Scotland; we did more than 6,500 units, so we were well above the target.

However, we are now at a tipping point whereby we are limited in what we can do with the resource that we have available to support that CPD. For us, it is about seeing what we can do by working in partnership with the Scottish Childminding Association and Early Years Scotland to support the needs that are undoubtedly there in the system.

Oliver Mundell: Do the other panel members think that it is odd that a significant proportion of a Government-funded initiative is being provided through the PVI sector but that possibly less training and support is going to practitioners working in that area?

Lorna Hay: That is not something that I am able to comment on.

Professor Yellowlees: I think that you have led us well towards answering yes. [*Laughter*.]

Oliver Mundell: Thank you. It concerns me, because I think that an anomaly has been created.

Is the provision in rural areas good enough? I am particularly interested in specialisation and cluster models, because they become more difficult in one-teacher or two-teacher schools, of which there are many across Scotland. Do we need to do more for rural areas?

Dr Petrie: Obviously, Dundee is a city but we are close to rural areas and I work with a lot of rural primary schools. There is some excellent practice in the one-teacher and two-teacher schools. In one school close to us, the pupils—primary 2s and 3s—tell us that they are a very computer science-based school and they are very proud of that. However, there are other schools that really struggle with the resources.

Part of that is about the teaching; if there is no teacher with knowledge of and advice about science and technology, that will always be a problem. It is also about the physical resources. Bigger schools in city centres often have an information technology suite where they can deliver computing science teaching and so on. That is less common in the rural schools—the ones that I see, anyway.

I know of a school with 12 laptops that are wheeled into the classroom as and when required, but they are so old that they have to be plugged in and that becomes a tripping hazard. The teacher would love to do something physical and active, because they are primary 2 pupils, and then something on the computer, but they cannot. They can do one or the other, because of the tripping hazard when the computers are in the room.

The internet is genuinely an issue in a lot of our rural schools. One rural school said that it cannot have all the computers accessing the internet at once or it will crash, which is a major issue for teaching computing science. The rural schools, especially those that have two classrooms and one or two teachers, have specific issues that the city centre schools perhaps do not have.

Professor Yellowlees: There is an issue with making sure that pupils in rural schools have the experiences that city pupils have. The science centres that are funded to do a lot of the STEM work are city based; I know that a lot of them have extensive rural programmes, but it is not the same. We have to spend time looking at how best to help all our communities have access to STEM teaching.

Computer internet-based learning has its place, but those of us who have enjoyed a career or an education deeply entrenched in science and engineering would also argue that pupils need the lab-based experience. They need to get their hands on. For many people, the practical aspects of science are the attraction of doing it. We have to make sure that we have a balance. Simply relying on the internet to provide all that experience will not work, in my book, because at the end of the day there will still be people who are not confident about undertaking an experiment and sometimes failing it.

Of course, people can fail on a computer too, but the experience of lab-based work and putting on the white lab coat, if that chimes in people's minds with doing a lab-based experiment, is important. We must not forget that, because if we discount practically based learning at that level, we are ignoring and discounting the whole of STEM, in my opinion. Rural schools encompass that situation beautifully, and if we can solve it there we have solved it everywhere. We need to look hard at how we can do that.

Oliver Mundell: Do you have any suggestions?

Professor Yellowlees: Yes. We have taken something like a cluster approach and put experts in place throughout Scotland. Each area now has an expert in STEM, although it will take time for them to go around. It is like a pyramid—we have put in the people at the top and we have to cascade it down. We have started well and the new initiatives will help that to happen, but it will take time.

Oliver Mundell: Thank you.

Dr Allan: I am interested in some of the issues around overcoming inequalities. The committee has talked before about how early we can see educational or life opportunity inequalities emerging in young children. I do not want to get into a discussion about how we measure such things, but what can we do at the very earliest stages to recognise inequalities in access to science, scientific outlook and scientific opportunities? What is the first thing that can be done in early years education to recognise where those gaps exist?

Professor Yellowlees: We have to look at the whole curriculum, be very self-critical about where those inequalities lie and ensure that we consciously address them. However, that has to happen across the board for all subjects, because science will benefit from that kind of approach. I am a great believer in the Institute of Physics's whole-school approach to this issue; although it began by looking at physics, it quickly realised that it was better to do this sort of thing across the whole school.

We have to be a lot more self-critical and, where it makes sense, be very prescriptive. Sometimes we just have to bite the bullet and say, "We're just

going to try this," but base what we do on experience elsewhere, if that is available.

Dr Petrie: Interdisciplinarity has a big part to play. For example, the traditional engineering degrees are still male dominated, while, at least in Dundee, degrees in anatomy are female dominated. Is there a science and technology degree that is equal? Yes—biomedical engineering. The subject is slightly dominated by women, but it is about 50:50, and that is because it appeals to those who are interested in engineering, science, the medical side of things and so on. We have to focus on that right from the early years in primary school and ensure that young people do not see this as a choice between becoming an engineer and becoming a biologist. There is no difference in the modern world—it is all about interdisciplinarity and everything working together.

Dr Allan: One aspect of overcoming inequality is, if you want to put it this way, overcoming economic inequalities—or certainly overcoming deprivation. I was interested in Professor Yellowlees's comment about including parents in this activity. What can actively be done to bring parents into class? I have certainly seen examples of that sort of thing being done to overcome parental—never mind children's—fears about science.

Professor Yellowlees: The issue is not just fears but misconceptions. There are a lot of misconceptions about what, for example, an engineer is, particularly from parents, and a whole lot of work has to be done to address that. For me, it is all about building science capital and ensuring that our society understands the importance of science, technology and engineering, where they stand and what they underpin. It is much easier to talk about pupils, because they come to a central point—the school—and then we can tackle these things through the curriculum.

I have been at many events that have involved children during the day and their parents at night. However, those parents tend to be interested in the subject already, because their children are interested in it. The real difficulty is with people who have not bought into the importance of science, engineering and other STEM subjects. I wish that I had the answer to that question, but I think that we all have a part to play, and I include science centres and science festivals in that.

Science festivals are being developed across Scotland, including in rural areas. Although they could be labelled as single interventions, I do not think that we should see them as that, because they have a much wider reach. We have to do more of that and think about how we can engage with the media to make everybody more aware of the benefits of science and engineering. There is not a single answer, although I wish that there was and then we would have done it. However, that is not true across the board.

It must be possible because, if we look across the world, we see that certain other countries have huge science capital and that their communities are well versed in the importance of science. We should look to see how they have done that, why it has worked and what we can do better here.

11:00

Dr Allan: What are those countries?

Professor Yellowlees: On engineering, for example, I would look at India, which is a hugely successful country where engineers are highly regarded and valued. Children go to school with the expectation that many of them will leave as engineers. We do not have that in Scotland. Much of the far east is like that as well. We should look to see why they value STEM so much more than we do in Scotland.

Shona Birrell: The issue of parental engagement is a much bigger discussion and is not just about STEM. Often, it is the same parents who come into schools all the time. Engaging all the parents is a much bigger issue that relates to everything. If a school puts on an event and invites parents, there will be a cohort of parents who want to be there and other parents who are disengaged and do not want to be part of their child's education. Parental engagement is a much bigger issue.

On Professor Yellowlees's point about other countries, I came across an example in Germany, where big mobile phone companies are creating resources for schools, such as discovery boxes, and providing training for early years teachers, which is widely spread across Germany. Other countries are promoting STEM in schools, including in the early years setting. That approach lends itself to learning through play and discovery in the early years.

Dr Petrie: To go back to a point that Lesley Yellowlees made, I was recently involved in Scotland's biggest-ever parents evening, and something that I heard quite a lot is that people think that science is hard. They think that science and engineering are for the academically brilliant who will go to university, get a first class degree and then do a PhD. We have to change that message, because there are lots of apprenticeships out there—modern apprenticeships, graduate apprenticeships and foundation apprenticeships—in science and especially in engineering. I wonder whether we can pair the apprenticeship message, which I am a big fan of, with the idea of science and

engineering being for everyone, with career paths for everyone.

Lorna Hay: To reiterate Shona Birrell's point about parental engagement, that is an issue, whatever we are talking about. We have been doing a lot of outdoor learning in our school, and we got one of our providers to put on an event in the school so that parents could engage in the activities that the children do to get an understanding of what they were learning, but we had only a handful of parents, which was disappointing. That issue goes across the board.

There are misconceptions. The research that I did last year for my postgraduate course showed that there are a lot of misconceptions about engineers and such careers. Most of the engineers who I spoke to in industry had been influenced towards that career path by a supportive parent. There are definitely issues that need to be addressed in the media and so on.

A few months ago, we had a big STEM event in our school to which we invited parents. We got the cohort that always comes, but there were other parents who perhaps do not normally come. The parents were building things with Kapla blocks with the children and making things out of K'Nex. There was a real buzz about the room and people were saying, "I had no idea that these were the kinds of things they do." We had an activity in which pupils had 100 blocks to build whatever they could in 100 seconds. It was like a scene from the "X Factor", with people cheering, "Come on!". It is not just about building things out of bricks, but that activity brought it down to a level that the pupils could relate to.

My school is looking to replicate the event annually and to work with the children on activities like that. We can do our bit in school to develop STEM capital, but unless something is happening at home with the parents, that will be a challenge.

Johann Lamont (Glasgow) (Lab): I am interested not just in access to STEM subjects and all those experiences but in the impact of disadvantage. An issue is not just that there is not much access but that there is disproportionately less access for more vulnerable children. If you rely on parental engagement, how do you make up for a lack of that for young people who might be in a care setting, such as looked-after children and care-experienced children?

Lorna Hay: When we had the event in our school, we had one or two looked-after children. One child's carer was with them to help them to engage in the activity.

Parental engagement is an issue not just for looked-after children but for any children with working parents. As you know, I am a teacher. When my girls came home the other day, they were upset because I was not there to share their learning with them, but I need to be in front of a class. Nowadays, both mum and dad might be working and they cannot always go to such events. That is a difficulty.

Johann Lamont: I empathise with that.

I am aware that the learned societies group, which Professor Yellowlees represents, did work on resources in schools.

Professor Yellowlees: Yes.

Johann Lamont: Will you expand on that? My concern from reading your report is that, although resource and support are issues, when parents are relied on to fill the gap, that reinforces disadvantage for already disadvantaged young people.

Professor Yellowlees: Absolutely. We did a body of work in 2014 and, only the other day, we were talking about the potential need to revisit some of its findings. We found that the resources that are available to teachers in primary schools to undertake STEM-type activities were an issue across the board. When we drilled further into that, we found that, if a school did not have the resource because it had not been given that by the local authority or because it had opted to spend its money in another way—we all recognise that such hard decisions have to be taken—it often had to go to external sources of funding.

The most common source of funding was parental funding, which was used to set up a club or to provide the materials, the equipment or whatever it was to do the STEM-type activity. There is a correlation between the children who come from a background in which the parents can afford to do that and those who have access to what that support provides. We should not underplay the contribution of parents who go in and help to teach such subjects, either. You are right that having less parental engagement impacts and impinges on those from less advantaged backgrounds.

Johann Lamont: Did you make recommendations about that? When the committee investigated musical instrument tuition, one problem that we found was that it is not regarded as a core subject. Should practical activities be regarded as core school business? In that way, they would not be at the mercy of having a talented parent or parents with resources to fund them. We could end up reinforcing inequality because of how resources are accessed. If you updated your 2014 work, I—and, I am sure, the committee—would be interested to hear what your recommendations were.

Professor Yellowlees: We were reluctant to draw firm conclusions, because we were aware

that we used a very small sample size. We received responses from only 39 primary schools, and we wished to engage with Education Scotland and other bodies to expand our sample size, but that offer was not taken up. Perhaps now would be a better time—sometimes we need to rely on timing—to find out whether there is an appetite to look at the matter further.

I am a scientist, so I love data. Whether we use data to provide a baseline from which to measure things, or whether it tells us something concrete in the first place, we need more data.

It worries me that not everybody has access to science teaching. Do I believe that it should be compulsory? Of course I do, but I would say that, wouldn't I? I say that for a variety of reasons. Such activities give young people good training and a skill set that will be important for whatever line of study or work they go into. I go back to the point that increasing the science capital of our population will end up yielding only positive results. I would make such teaching compulsory.

Alastair MacGregor: I agree. A number of primary school teachers and early years practitioners come through the SSERC annually. From 1 April 2018 to 31 March 2019, there were 3,285 primary teacher attendances at our professional learning courses. It would be soul destroying if, after we had provided all that hands-on, practical and experiential learning, which is underpinned by the development of knowledge and skills, teachers could not use that learning in a classroom setting.

We are fortunate that some of the money that we are allocated from, for example, the Scottish Government is dedicated to providing resources for the delegates who come to our courses. If we undertake a practically based activity with a primary delegate or an early years practitioner, they take the resources back to their base.

Through our external partnerships, such as that with the Edina Trust, any school that participates in a professional learning activity in the SSERC is eligible to apply for a £350 grant. The Primary Science Teaching Trust provides us with a significant amount of money—about £50,000—to support the development of bespoke CPD in the cluster communities, and some of that money is used to buy resources for that purpose. It would be great if there was a core funding stream to support practical STEM-based activities in primary school classrooms and early years establishments.

Johann Lamont: Should the inspection regime interrogate that and look at what is happening in schools?

Alastair MacGregor: If a lack of resources is having a detrimental effect on attainment,

enjoyment and efficacy in relation to science, the inspection regime should look at that.

The Convener: Does Dr Petrie want to come in?

Dr Petrie: I am nodding because I completely agree with what has been said. There might be an issue if inspections were not looking at practical skills, what is going on in the classroom and the resources that are available. That applies not only across STEM but across everything. Teachers need to have the resources to teach the full curriculum. If they do not have those resources, we will have a massive issue.

The Convener: I think that Ms Birrell wanted to speak about looked-after children. I am sorry that we have moved on a bit.

Shona Birrell: Pupil equity funding could play a role. I know that Lorna Hay's school is using PEF for STEM, so she might want to talk about that. The issue is the sustainability of PEF and whether it will keep being provided.

11:15

Lorna Hay: As teachers, we want our lives to be made easy. Opening a box that has all the kit to teach a science lesson takes two minutes, whereas raking about in the cupboards to try to find a Petri dish might take three hours of our non-class contact time, so let us get as many kits as we can.

As STEM is in our school improvement plan, some PEF has been used to drive initiatives in the school—for example, I was partly PEF funded this year. We are lucky to have been able to use some of that money for resources that can be used sustainably—PEF resources need to be sustainable and to be able to be used practically, whether they are resources for computing science or things such as Lego, K'Nex or Kapla.

However, we are aware that PEF funding is not a bottomless pot. We are fortunate in our school to have excellent access to wi-fi, which means that we can do a lot. I absolutely agree with Professor Yellowlees's point about practical science and not doing everything on the internet, but internet access supports teaching the children about things such as coding on netbooks, and that is where the resources are a problem.

Yesterday, I went to my nursery and spoke about computing science and information and communications technology. The people there said that they had one smartboard and a couple of Bee-Bots and that is it. There are so many opportunities out there for developing computational skills, which are transferable skills—they are not related only to a science context. I did a lot of research and I really value

the engineering habits of mind approach, which we are pushing through our school. It involves skills such as systems thinking, improving, problem finding, creative problem solving and adapting, all of which are exclusive not to engineering but to life.

The concern is about how we fund all those things. As Alastair MacGregor said, there is nothing worse than going on courses and finding them brilliant and excellent, as I have done, then getting back to school and realising that we cannot do something because we do not have this or we do not have that. Sometimes I go to the shop and buy things out of my own pocket. However, I cannot fund resources for a whole class out of my own money.

Professor Yellowlees: Or for a whole school.

Lorna Hay: Or for a whole school—absolutely.

Dr Petrie: A lot of our teachers are buying resources. That point came out at the TRIC digifest, where a lot of people said that they had bought a Bee-Bot for their nursery because it did not have one. It is appalling that our teachers are paying for things for classes out of their own pockets.

There cannot be just a one-off injection of funding, because the nature of science and—especially—technology means that things go out of date quickly, as a number of our schools have seen. For example, a school might have bought 20 laptops three years ago that already do not have battery life left and are beginning to die, so the school will be concerned about how it will replace them.

We have to be aware that the funding stream must be continuous. Such things change quickly and we want to keep up and ensure that pupils have the best resources and are learning about the latest technology—not that of five years ago.

The Convener: Before we move on from resources, I will ask about the role of technicians, which the SSERC has published material on. Although they are mainly for secondary schools, I know that school technicians work with primary cluster programmes. Is what is happening with school technicians having an impact on the ability to do practical work?

Alastair MacGregor: The two primary practitioners are probably best placed to comment but, if a primary school teacher wants to undertake STEM-based practical activities in the classroom situation, who sets that up? It has to be the teacher. When do they do that? They have to do that when they have non-teaching time. How much non-teaching time do they have? Not very much. There are major issues in relation to secondary school education and the issues are perhaps not as acute in the primary sector, but I am happy to be proven wrong.

Lorna Hay: I have no experience of a technician coming into my school to set things up. That would be wonderful—like some kind of fairy coming in. It is the same when we have a gym lesson. We have to get the stuff out of the cupboard before the kids come in, so we do it at break time. That is a useful time to set up a science experiment but, if a teacher works in 50-minute periods and does not start until 10 minutes to 12, and the previous teacher is still in the room, when do they set it up? If they are lucky, they might ask their pupil support assistant to do that but, if they have a pupil support assistant only for 50 minutes in a week, that is a struggle.

More hands are needed to do such work. Sometimes we have to rely on older children to get things out for younger children. I have seen no technicians in my experience of primary schools.

The Convener: Gordon MacDonald has had to leave the meeting; he gives his apologies to the panel.

We will move on to gender.

Rona Mackay (Strathkelvin and Bearsden) (SNP): We touched on gender equality, or inequality, last week, when one of our witnesses, Elisabeth Kelly, suggested that the extent to which gender neutrality features as a theme in training of early years practitioners is mixed, and is dependent on who is delivering the training. How much does the training focus on it? Once the training is in place, is its success dependent on the personal attitude and determination to deliver gender neutral training of the early years manager?

Professor Yellowlees: Unfortunately, at the moment, the answer to that is that it does. I return to my point that we have to look at the curriculum as a whole, and we have to make sure that it is gender neutral. We are aware that biases can creep into children at a very young age. The press has been full of examples: we are not short of them.

We are, however, short of a concerted effort to change the culture and make having a biased curriculum unacceptable. I do not believe for a moment that anybody deliberately set out to make the curriculum biased, but do I believe that bias exists? Yes, I do—in some subjects, it exists. It should not be there: it should be called out wherever it is found, because it does nobody any favours.

Rona Mackay: On that point, in the absence of key performance indicators in STEM subjects, how can bias be measured? Should school inspections pick up on it?

Professor Yellowlees: Yes—but school inspection can come further down the line. Right from the word go, I would pull experts in to look at our curriculum and I would ask them whether or not it is delivering what we want it to deliver. We could bring in experts from outside Scotland, or we could ask well-qualified and well-versed teachers to look at the curriculum, because they are as able as anybody is to see where problems lie. However, they have to be given the explicit instruction to do that.

There is no point in just talking around the matter, because that will not help. We need strong intervention. The approach has to go from early education all the way through—it has to be joined up. There is no point in looking at gender bias just in nursery provision and then hoping that things will be okay in primary school. That will not work.

Rona Mackay: How do we continue the approach? What if the approach has a good presence and grounding in early years education, but time pressures on the curriculum in primary school mean that it drops off?

Also, given that gender stereotyping happens very much in the home in the early years, is there a sense in which that will always be a battle? I do not really expect you to know how to tackle that. It is a wider issue.

Professor Yellowlees: Of course it is a wider issue; it is a societal issue and society needs to wake up to that. Society needs to take ownership of the issue and say that the gender bias is not acceptable. Let us consider the #MeToo campaign. Do I like all of it? No, but I like that it has highlighted an issue and made it acceptable to talk about it. We have to make bias in the curriculum unacceptable for our young people, because we are not doing anybody any favours if it exists.

How should that be delivered? Strong leadership must be shown. We have to step up to the plate and say that bias in the curriculum is not acceptable and say what we are going to do about it. To be perfectly honest, I think that the Scottish Government has to take the lead. Any other way would be much slower; I want it to be delivered quickly.

Shona Birrell: On Rona Mackay's question, gender bias should be looked at more carefully, but I do not see that happening as part of schools' self-evaluation. Looking at gender bias could be a really useful tool for schools. Schools could talk to children and parents about why the children play with certain toys or go to certain clubs and they could consider, with parents, how to address barriers.

I take my daughter to a young engineers club once a week. She is three years old and is the only girl in the group, with seven or eight older boys, and she does just as well as them. She is interested in building and does not see it as being for boys. That is just an example from my experience as a parent, but we could look at the messages that we are giving children in early years settings and primary schools, and at the messages that parents are giving them, and we could evaluate that information and look at how to build on it.

Lorna Hay: I want to pick up on a point from the report. The improving gender bias team, which we have been working alongside, is doing an incredible amount of good work. We had one of the pilot schools and nurseries, and that has fed through into our other schools. The Government has provided money to expand that team, which can only be a positive thing. Its work needs to be disseminated to everyone.

In our school, two or three years ago when we asked the children what an engineer was, they would answer that it was Bob the Builder—a man with a hard hat. Now, we are getting much more diverse answers about aeronautical engineers, female engineers and all sorts. That is certainly because of the work that the improving gender bias team did with us, which has changed our attitudes and, perhaps, some of the language that we use. Anything that can be done to add to what that team is doing will be hugely beneficial.

Shona Birrell: Professor Yellowlees mentioned the media. On the back of what Lorna Hay has said, I am thinking about how the media portrayed one of the lead scientists who recently photographed the black hole and who is female. Is there a role for the media in putting more information out about gender stereotypes? Not all scientists and engineers are male—or female; there is a range of people of different genders in different roles. Can the media play a part in breaking down those stereotypes?

Alastair MacGregor: Lorna Hay made the point that Education Scotland has now recruited an equalities team, each member of which is linked to a regional improvement collaborative. I will put my positive hat on again and say that that offers an opportunity for us to make sure that equalities provision is also part of the national picture. By "equalities" I do not mean only gender; we have focused a lot on gender, but we have also talked about cared-for children.

I also agree with Lesley Yellowlees that the lead needs to come from the top; we ask our early years practitioners and primary school teachers to do enough. In their professional learning priorities for the next academic year, the top thing is pedagogies and teaching approaches to deliver STEM learning effectively, to ensure skills progression in STEM subjects, and then to use

STEM to raise attainment in literacy and numeracy. Improving equality and equity is number 12 on a list of 17. Rightly or wrongly, their priorities sit elsewhere at the moment, so having that top-level intervention might be the way to tackle the situation.

11:30

Dr Petrie: We must also look at the role of parents, carers and general society. Based on my experience, I think that grandparents can also play quite a large role.

I am a big fan of the let toys be toys campaign, which has done a lot of good work throughout the UK. I do not know whether members are aware of the campaign: it says that we should not gender toys and asks toy shops and providers to not gender anything, including clothes and toys. The Scottish Government could get behind that campaign and change how our retailers work in Scotland. That could have quite an impact on parents and carers.

Rona Mackay: I have a generic question for Dr Petrie about computing as a subject. When my son was at school, it was generally the boys who took computing. Has that levelled out? I hope so.

Dr Petrie: It has not, really—it has been going backwards for the past three years, in high schools. Fewer girls are taking national 5, higher and advanced higher computing science. There is hope in primary schools. Computing science is part of curriculum for excellence and has been part of the broad general education for about five years, so we are seeing far more of those younger people really engaging with and getting excited about computing science. My general hope is that, when those young people get to high school, we will begin to see a change.

Alastair MacGregor: There is also an issue about what happens when people who have undertaken lots of digital skills training during their primary schooling move to a secondary school where there is no computing science department. That is happening, increasingly.

Dr Petrie: That is a big issue. It is not unusual for a high school to collect in from, say, 20 feeder primary schools, especially in rural Scotland. Often, one or two of the primary schools are highly digitally focused and have done a lot of work in the area, and their pupils go to high school really enthusiastic, but the primary school teachers come back and tell me that lots of students who had wanted to study STEM are now bored because they are doing what they did in primary 6. There is a real challenge for high schools.

The Convener: That concludes questions from the committee. I thank all the panellists for coming in. Your evidence has been helpful, and we appreciate your contributions.

Lorna Hay: Could I add something?

The Convener: Yes.

Lorna Hay: I was just reading the committee papers, in which there is a suggested question about whether we think that, if we want an interdisciplinary training approach, there is any point in training teachers to be specialists in one particular area. My feeling is that we should still be doing that if we want to take an interdisciplinary learning approach and a teacher is not confident in an aspect of STEM. I have a couple of anecdotes that might help.

I am doing a Primary Engineer car challenge with my class. The interdisciplinary learning includes maths, because they measure the wood before they cut it and they are working to a budget to buy the resources; social studies, because they are talking about the sustainability of electric vehicles; science, because they are talking about forces and electricity; and literacy, because they are reporting on their progress.

I am also reading a book called "The Boy Who Harnessed the Wind", which is about William Kamkwamba. I do not know whether the committee is familiar with his name; he built a wind turbine in Malawi, and in the book, he talks about finding out about electromagnetism in motors and being fascinated by it. Because I had the confidence to do so, I was able this week to take a sidestep: we have been wrapping wire around nails to get paper clips to stick magnetically. A teacher who did not have the same confidence might not have taken that sidestep to deepen young people's understanding. An interdisciplinary approach is great, but I still think that teachers need CPD and the training to make the cross-curricular links.

The Convener: Industry has been mentioned: we know of programmes such as barefoot computing and industry-funded clubs that are providing encouragement to young people. Tomorrow, there will be a debate in the chamber that will involve many of the Scottish Parliament's species champions. As species champion for the pearl-bordered fritillary, I know that the Butterfly Trust has put a number of projects in place, although it mainly works with schools in England. Have either of the practitioners on the panel come across charities or organisations, for example RSPB Scotland, that are not necessarily part of industry but which are still supporting the work of schools?

Shona Birrell: RSPB has come into schools and talked to children, but I have not had much experience of other charities being willing to come in and work with children.

Lorna Hay: We have had fantastic workshops with Bee Buddies. Wild Planet Explorers has been into the school, and Bright Green Hydrogen has done a lot of workshops, too. Obviously, though, we pay for those services. To go back to the earlier conversation about equity, I point out that those people have been coming into the school because Laura Peden and I are driven to seek out such opportunities. If schools do not have people with the same kind of passion, such opportunities will pass them by. Those organisations publicise themselves, but their emails come into people's inboxes along with everything else, and I have had colleagues tell me that they just delete them. The reality is that their focus is probably on something else.

Shona Birrell: I concur. When, as part of the developing the young workforce programme, I tried to get people from the arts to come in and talk about their jobs to our children, they would email me to say that they did not have the funding, the time and so on. From charities, one person from Youth Theatre Arts was able to come into the school, but she had dedicated funding to do that sort of thing.

Alastair MacGregor: The STEM ambassador network in Scotland comprises something like 2,600 ambassadors who give up their time to support the educational community in Scotland. They are a superb resource with which to make contact.

Lorna Hay: We have had 17 engineers sourced from the STEM ambassador network come into our school. That network needs to be tapped into; after all, if those people get an email from me, asking "Will you come to our school?", they will be able to meet their CPD requirements for the year. It is an absolutely fantastic resource.

Dr Petrie: I will speak slightly against the barefoot computing resource, which was referred to. That is perhaps not a very good thing to do, given that I am here to represent my organisation. However, I will be honest and point out that the resource was developed primarily for the English curriculum. It is used a lot in Scottish schools—I know that Education Scotland promotes it—and it has some great stuff in it, but because it has been developed for a different curriculum, it might not fit classroom pedagogy or resources.

There are lots of really good resources out there. I would prefer to see us mapping intended learning outcomes to a wide variety of resources, then allowing teachers to choose what fits their curriculums and interdisciplinarity. After all, the barefoot programme is very computing based and computing driven. I am a big fan of Grok Learning, which comes from Australia and is far more interdisciplinary. One great primary school resource features a cat with a green nose, and the children have to work through the programming to find out what happened to it and why its nose is green. It also teaches kids about biology and other things—it is a really interesting way of working.

All those resources are great, and it is great that we have them, but one thing does not and should not fit all.

Professor Yellowlees: The learned societies, of course, include computing societies, which tend to be UK-based. Many try to tailor what they do for Scotland, but it does not always work. Nevertheless, the learned societies, as well as charities, have a huge part to play, and they try to play it. However, in my opinion, making such things sustainable and taking them forward requires resources at individual school level. The charities and learned societies can help enormously, but if schools cannot buy into provision because of a lack of resources, their help will not continue, which will be very sad.

The Convener: I thank you again for your attendance this morning. Before we move into private session, I point out that we will be having another evidence-taking session at our next meeting on 26 June.

11:41

Meeting continued in private until 11:58.

This is the final edition of the *Official Report* of this meeting. It is part of the Scottish Parliament *Official Report* archive and has been sent for legal deposit.