



The Scottish Parliament
Pàrlamaid na h-Alba

Official Report

EDUCATION AND CULTURE COMMITTEE

Tuesday 27 January 2015

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EDUCATION AND CULTURE COMMITTEE

2nd Meeting 2015, Session 4

CONVENER

*Stewart Maxwell (West Scotland) (SNP)

DEPUTY CONVENER

*Siobhan McMahon (Central Scotland) (Lab)

COMMITTEE MEMBERS

*George Adam (Paisley) (SNP)
*Colin Beattie (Midlothian North and Musselburgh) (SNP)
*Chic Brodie (South Scotland) (SNP)
*Mark Griffin (Central Scotland) (Lab)
*Gordon MacDonald (Edinburgh Pentlands) (SNP)
*Liam McArthur (Orkney Islands) (LD)
*Mary Scanlon (Highlands and Islands) (Con)

*attended

THE FOLLOWING ALSO PARTICIPATED:

Dr Bill Beveridge (Learned Societies Group)
Professor Sally Brown (Learned Societies Group)
Stuart Farmer (Learned Societies Group)
Kate Farrell (Learned Societies Group)
Iain Gray (East Lothian) (Lab)
Dr Liz Lakin (Learned Societies Group)

CLERK TO THE COMMITTEE

Terry Shevlin

LOCATION

The James Clerk Maxwell Room (CR4)

Scottish Parliament

Education and Culture Committee

Tuesday 27 January 2015

[The Convener opened the meeting at 10:00]

Interests

The Convener (Stewart Maxwell): Good morning. I welcome everybody to the second meeting in 2015 of the Education and Culture Committee. I remind all those present that electronic devices should be switched off.

I welcome Siobhan McMahon to the committee as a new member, and I welcome Iain Gray, who is here as a member, but not a member of the committee.

At our previous meeting, Siobhan McMahon was elected in her absence as the committee's deputy convener. I congratulate her on being elected to that post and invite her to declare any relevant registrable interests.

Siobhan McMahon (Central Scotland) (Lab): Thank you, convener. I do not have anything to declare.

Decision on Taking Business in Private

10:01

The Convener: Agenda item 2 is a decision on whether to take in private item 5, under which we will discuss a letter from Claire Baker MSP about the Victoria and Albert museum in Dundee, which contains a suggestion for our work programme. Do members agree to take item 5 in private?

Members *indicated agreement.*

Public Petition

Young Carers' Grant (PE1470)

10:01

The Convener: Agenda item 3 is consideration of petition PE1470, which was from the Scottish Youth Parliament.

As members will see from the briefing paper, the petitioner is now content for the petition to be closed. I think that a petitioner's asking for a petition to be closed is unique in my experience. However, it is for committees to decide whether they wish to close petitions, so I invite the committee to consider what further action, if any, it wishes to take.

Liam McArthur (Orkney Islands) (LD): I am happy for the petition to be closed, but we should put on the record our congratulations on the outcome of the petitioners' efforts.

The Convener: Do members agree?

Members *indicated agreement.*

The Convener: On behalf of the committee, I reiterate what Liam McArthur said about the work that the Scottish Youth Parliament has undertaken. I thank it for all its efforts. The petition is now closed.

Science Education

10:02

The Convener: Agenda item 4 is a discussion on the implications of a recent report on the resourcing of science in Scottish schools, which was published by the learned societies group on Scottish science education. The committee previously agreed to undertake work on science, technology, engineering and maths—or the STEM subjects, as they are better known. Today's session is the first step in that process.

I welcome Professor Sally Brown, Stuart Farmer, Dr Bill Beveridge, Dr Liz Lakin and Kate Farrell. I thank them all very much for coming along and giving up their time for the committee.

We have around an hour to spend on this item. Without further ado, we will go straight to questions from members, if the witnesses do not mind. I am quite happy for all the witnesses to answer a question if they feel that they have something to contribute, but if somebody has already covered an issue, they do not need to repeat what has been said. I thank you very much for your support.

Chic Brodie (South Scotland) (SNP): Good morning. In a general context, some of the figures that we have seen are quite heartening. In the Economy, Energy and Tourism Committee, of which I am also a member, we discussed the problem of challenging young people to get involved in the engineering industry. What are you doing to attract more students into studying the STEM subjects?

Professor Sally Brown (Learned Societies Group): We very much support the recent reforms in education; I said “recent”, but those reforms have been going on for some years now. Therefore, anything that we do is to try to improve the situation with regard to the curriculum for excellence and the role that it has to play—for example, in primary education.

In a sense, we are moving the STEM subjects back into primary education. Maths has been in primary education consistently, but the record for science in primary education has been less encouraging. Bill Beveridge from the Royal Society of Chemistry will say something about that, because that society has a particular focus on starting everything at the primary level.

As you know from our submission to the committee, as well as our report on resourcing, we have been conducting an independent search for evidence on how things are going in schools. Certain things are of concern not only to us, but to teachers and schools. For example, there is

concern about the curriculum structure, and in particular the move from a two-plus-two-plus-two structure to a three-plus-three structure and the impact that that might have on pupils' ability to continue with the subjects that they need in order to gain entry to further or higher education courses.

That was our group's general focus. I turn to Bill Beveridge first, but the other members of the group might be able to say something more about their particular learned society and specific science.

Chic Brodie: One element of our discussion in the Economy, Energy and Tourism Committee involved those who work in industry or in the science sector. Invariably, it seemed that nobody ever talked to parents in depth about how attractive the STEM sector might be.

In your answer, Dr Beveridge, can you indicate how much of your survey applied to parents and whether they want their children to be involved in science?

Dr Bill Beveridge (Learned Societies Group): You raise some excellent points. One concern of all our learned societies is to promote to the entire community—not just school pupils, but parents and grandparents, and the whole of society—the important role that STEM subjects play.

You asked what we are doing to promote those subjects. Each of our organisations has a different programme. The Royal Society of Chemistry has a programme called chemistry at work, which brings people who use chemistry in their everyday employment into secondary schools and—very importantly—into primary schools to showcase what chemists do. The important point is that those chemists do not work only in areas such as the petrochemical industry: we have people from the fire service, the food industry and the textiles industry coming along. We view that as very important.

As Sally Brown mentioned, one of the most important things for us at present is to consider the primary school stage. There is overwhelming evidence that the attitudes that a child forms at the very early stages of their career will be set for life.

Chic Brodie: Forgive me, but children can be disabused of those attitudes by parents who may take a different view of the sector. Is that the case?

Dr Beveridge: Again, you are absolutely right. The Royal Society of Chemistry is looking this year at funding an initiative in Scotland to take the message out to communities, in particular remote and rural communities, to showcase the important role that chemistry plays in other STEM subjects. In that pilot, we are looking at speaking not just to

the audiences that we traditionally speak to, such as school pupils, but to the families—the parents and grandparents—because, as you rightly say, attitudes in the home are crucial.

Mark Griffin (Central Scotland) (Lab): I have a quick question on your report and the survey sample. In a debate that was held last week in the chamber, a question was asked about the survey sample and whether the figures in your report could be used to analyse the picture throughout Scotland. A survey of 12 per cent of secondary schools is clearly not insignificant. Could the Government do a body of work to emulate the work that was done in producing the report to give a more accurate picture of what is going on across Scotland?

Professor Brown: I will start, and then I will hand over to Stuart Farmer. One of the concerns that led us to undertake the gathering of evidence was that there has not been enough gathering of independent evidence in relation to the reforms. That is our first concern.

I think that you said that a sample of 12 per cent of schools was insignificant.

Mark Griffin: No—I said that it was not insignificant.

Professor Brown: I am sorry. I did not hear the “not”.

A sample of that size is relatively significant, although that figure does not apply to the sample that we took of primary schools. We did not take a sample of 12 per cent of them.

The Convener: I am not sure whether the panel listened to last week’s debate or read the *Official Report* of it. I raised a question about the 2 per cent sample size for primary schools, not secondary schools.

Professor Brown: The sample size for primary schools was certainly much smaller. The findings were pretty much in line with what the individual societies had found from their own experience, but it is true that we do not have a large packet of evidence available on primary schools.

Stuart Farmer (Learned Societies Group): The learned societies would like more work to be done in this area. The group decided to follow up on the resourcing of science in Scottish schools because the science and engineering education advisory group recommended in recommendations 4.11 to 4.13 of its 2012 report that a proper independent study be done to identify the resources required to adequately deliver the curriculum. Unfortunately, those recommendations were among the ones that were rejected in the Government’s response.

However, the learned societies felt that the issue was sufficiently important to allow them to devote a small amount of funding to carry out some independent evidence gathering. We would have liked to do a sufficiently large study to enable us to present findings that had a statistical basis of 95 per cent confidence with a 5 per cent error but, on doing the analysis, we discovered that that would have required us to sample 200 or more secondary schools in Scotland and a slightly greater number of primary schools. The resources that were available to what are, in effect, charitable, member-funded organisations were not sufficient to allow us to do that.

However, we attempted to provide as representative a sample as possible. We wanted to ensure that as many local authorities as possible were represented and that large, small, rural, urban and island schools were all represented. Particularly in the case of secondary schools, the sample that we used had good representation from all those groups. We ended up getting a statistical sample where the error on 95 per cent confidence is about 14 per cent.

If I use the secondary figures as a base, you will have seen that the outcome indicates that the funding for an average school in the sample of £5,590 per annum is about 19 per cent of what we estimated to be a reasonable sum to maintain the resourcing level—as opposed to starting from scratch—in secondary schools. With a 14 per cent error, if we give the benefit of the doubt and increase the amount by 14 per cent, that still only increases the sums available to about 24 per cent of what we estimate to be reasonable.

The sample is small, but the findings from it bear remarkable comparison with the study that was done between 2001 and 2003. Although that was done for only physics departments in Scottish secondary schools rather than all schools, the study was nevertheless based on a sample of 120 schools across Scotland. In other words, more than 30 per cent of all schools made a return. Taken together, the two studies have an element of breadth and depth and provide representative figures over an extended time period.

We therefore strongly recommend that consideration be given to undertaking further research on and getting independent evidence of the real situation in Scotland. The learned societies group has done as much as it has been able to do within the timescale and the resources available to it.

10:15

Mark Griffin: On the issue of resources, which you have just touched on, you have estimated an annual science budget of just under £30,000 for

the average Scottish secondary school. Have you worked out what increase in funding that would mean Scotland-wide, and have you done any analysis of whether that sum could be met from local authority budgets or whether it would require additional funding from central Government?

Stuart Farmer: We have not done any work on where that funding ought to come from; we have estimated what we feel is a reasonable sum to deliver the curriculum, and that analysis is based on evidence that historically started with work that was undertaken by the Royal Society in London and the Association for Science Education 20 or more years ago and which has been updated at various points since then. As I said, we have come up with a reasonable estimate for a care and maintenance budget for reasonably delivering the curriculum.

Mark Griffin: Reports in the press at the weekend suggested that an additional £8 million would be required annually. Do you think that that is an accurate reflection of what you said in your report?

Stuart Farmer: I think that that is reasonable.

Mark Griffin: My last question is about the comparisons that you make in your report between spend in other parts of the UK and spend in Scotland—

The Convener: I am sorry to interrupt, Mark, but a number of members want to ask supplementaries on the previous issue. I will come back to you in a moment.

Gordon MacDonald (Edinburgh Pentlands) (SNP): I will ask a couple of questions later about primary education, but with regard to Mark Griffin's question on the sample size I thought that it would be appropriate to put your findings in context.

Particularly with regard to primary schools, what was the size of the sample that was originally identified? What was the response rate from primary schools? Finally, was it self-selecting? In other words, did schools decide whether to opt in or opt out, or did you invite them? How was the sample put together?

Stuart Farmer: We tried to identify through learned societies group contacts named contacts in schools, and the initial sample was put together by invitation. At the same time, however, we put out a general invitation to the education sector to respond. The consultancy firm that carried out the research analysed the sample on the basis of full and adequate responses. We got only partial responses from some; as is inevitable with such surveys, no matter how well we design them, we do not always get as full a completion rate as we would like.

Gordon MacDonald: If my understanding is correct, 39 primary schools took part in the survey.

Stuart Farmer: That is right.

Gordon MacDonald: How many primary schools did you invite?

Stuart Farmer: I cannot give you an exact number off the top of my head, but it was slightly more than that. We also made a wider and more general invitation through networks, so there was an open invitation to contribute as well as the invitation that we made to the named contacts we had identified. That figure was in excess of 50, but I cannot remember the exact number off the top of my head.

Gordon MacDonald: Given that you made a general call to, I presume, all 32 local authorities, are you disappointed with the response rate?

Stuart Farmer: We were slightly disappointed with the response. We had hoped to get 50 fully completed surveys.

Colin Beattie (Midlothian North and Musselburgh) (SNP): I want to go back to the issue of resources. A key element of the papers that have been submitted to us is the view that insufficient resources are being allocated to the areas in question. However, tables in one of the committee papers show figures for entrants for highers in selected subjects and passes in those highers, and figures for entrants for advanced highers and passes in those, and most of the figures are at record levels. The figures show huge increases in the numbers of entrants and passes between 2009 and 2014. What would additional resources add to that situation? What improvements would we see from additional resources, beyond what we are already seeing?

Stuart Farmer: We have had communication with a wide variety of learned society stakeholders such as the Institute of Physics and the Royal Society of Chemistry, which have a large representation from industry and higher education, and there is a consistent message from the learned societies of concern about the practical investigative and problem-solving skills that our young people are developing.

There is concern within the learned societies that too much of the practical science that is reported as being done in secondary schools and primary schools, but particularly in secondary schools in this case, involves the teacher demonstrating experiments and so on to the class because there is a shortage of equipment. There might be only one piece of equipment rather than, say, 10 pieces, which would allow pupils to do hands-on experiments themselves.

There are therefore concerns that, although the basic knowledge in science subjects is being

taught well—the figures that you quoted show that lots of pupils are seeing positive benefits from studying science subjects—pupils are not developing as fully as we would wish the hands-on, practical skills or the deeper analytical skills that can be gained through doing experimental work.

Colin Beattie: Are you saying that it is industry that is coming to you and saying that?

Stuart Farmer: There is information from industry and from higher education generally—in other words, from the places that our young people go on to when they leave school.

Colin Beattie: Surely industry has ways of feeding that back, and not just through your members. There are many engagements between education and industry that would receive that feedback and take it into account. Surely that is part of what we are seeing in the outcomes. I am struggling a wee bit on this one.

Professor Brown: To repeat our concern, I note that there has not been a significant amount of independent, systematic evidence gathering on the issue. That certainly applies in relation to the connections that exist between industry, school education, higher education and so on. Of course, plenty of people give opinions and one can collect one's own set of anecdotes on the issue. However, a particular message comes continually from people who write about it, although that is not systematic evidence.

You are probably all too young to remember the changes that were made in the 1960s, when we went into alternative science syllabuses and there was quite an extraordinary change in the amount of practical work that young people did compared with previously, when something was just demonstrated by the teacher. Sadly, over the years, the amount of practical work has diminished, and I can give you anecdotal statements from people about that. Teachers often say, "Of course, it's all because of health and safety regulations", but I do not believe that that is the case, although some health and safety reasons might be involved.

There are a lot of reasons why young people do not do as much practical work, but it is not good for our future. Every week we see concerns expressed—on television and elsewhere—about the loss of practical skills in many different environments. As I said, we have a lot of anecdotal evidence on the issue, but we do not have systematic evidence, which is what we want.

Colin Beattie: Is it not a little odd to make assertions based on anecdotal evidence? Is there hard evidence to back up what you say?

Professor Brown: We are trying to provide some evidence that approaches being hard evidence. However, as I have said from the start of the meeting, our primary concern is that we as a country are not looking for systematic, independent evidence in the way that we should be. My answer to your question is that we are very short of hard evidence. We have perhaps the closest thing to it, but it is not enough.

May I ask Liz Lakin to comment on teacher education?

The Convener: Yes.

Dr Liz Lakin (Learned Societies Group): I am here representing the Society of Biology, but I work at the University of Dundee in initial teacher education. What has come through, particularly from the experience of the Society of Biology, is that there is evidence from across the United Kingdom that science students are coming into employment and higher education without the fully developed skills that Stuart Farmer mentioned. That has prompted the society to develop an accreditation scheme that is looking at university degrees so that the students who come out with them have developed the necessary skills.

The fact that we are doing that shows that there is concern up and down the country that something needs to be done in school education to promote and develop skills in practical work. The skills involve students being able to assess the nature of science and the way it actually works, to look at the evidence that they get and to be proactive in what they are trying to do. They should be able to look at the quality of the evidence that they have and say, "I know where I can go with this and what I can do with it." Students do not have those skills at present; they do not seem to be coming out with them. The skills are having to be addressed a lot later on, rather than at secondary school, where they should be addressed.

Evidence is available, but it is from across the country and not specifically in what we are talking about here.

The Convener: Thank you. I will come back to Dr Beveridge, but three members have supplementary questions on the issue and I rudely interrupted Mark Griffin earlier, so I want to come back to him, too. I do not want to get stuck on this particular issue, but we will have quick supplementary questions from Liam McArthur, Mary Scanlon and Iain Gray, and then we will go back to Mark Griffin.

Liam McArthur: Good morning. I was struck by the conversation about the sample size in relation to the primary sector. The Scottish Government's programme for government for 2014-15 said that the minister would

“Continue to support improvement in the learning and teaching of”

STEM subjects

“in schools, with a particular focus on primary schools.”

Given that priority, do you not find it astonishing that the focus is on the small sample size in the survey that you conducted rather than on some of the issues that it has thrown up and a determination to get to the bottom of them in one way or another?

In addition, to follow up on Colin Beattie's question, I note that the statistics on the pass rates are a bit of a mixed bag. For example, the pass rates for higher biology and higher physics have gone down, but the rates for other highs have gone up. The pass rate for the advanced higher in chemistry has gone down, albeit that the rates for other advanced highs have gone up.

However, the real issue that is thrown up by the survey that you conducted is that the problems that we are seeing in primary school will only manifest themselves in the secondary sector, in relation to highs and advanced highs, in a number of years' time. In essence, there will be a lag effect for the issues that your survey has thrown up.

Professor Brown: Yes. Of course, we are working in the context of the reforms of the past few years. As you know, we have only just reached the point of moving into the highs and advanced highs. We will have to see what the impact is, but there are big questions about whether the reforms, which had support across all political parties and certainly from us, are being implemented in such a way that young people are better prepared not just for highs and advanced highs, but for the future of STEM in Scotland. It is the implementation that is the question.

10:30

Mary Scanlon (Highlands and Islands) (Con): We have been given a set of figures from the Scottish Parliament information centre, and I—like Colin Beattie—was surprised to see that increasing numbers of students are being entered for highs and advanced highs. I would have expected the trend to go in the other direction. If we take the information—

Professor Brown: We do not know which direction it is going in at present.

Mary Scanlon: Well, the trend that I can see—

Professor Brown: There was a trend—

Mary Scanlon: Between 2009 and 2014.

Professor Brown: Yes—a historical trend.

Mary Scanlon: In some areas, such as information systems, there is a slight decline, but generally speaking the numbers are increasing.

Your paper states:

“SQA presentation data for the 2014 qualifications indicate reduced numbers”.

It shows that biology is down by 8.9 per cent, chemistry is down by 8.8 per cent, physics is down by 5.6 per cent, computing-related courses are down by 22.4 per cent and maths is down by 9.4 per cent.

I am struggling to see what is happening. Your paper shows that all the figures in the Scottish Qualifications Authority presentation data are down, and yet all the figures that we have—as an economist, I have looked at them very carefully—show a trend in the opposite direction. I am trying to establish why I have two separate sets of figures and why yours show a trend in the wrong direction while the figures in the SPICe paper show that the trend is up.

Dr Beveridge: That is a pertinent point. The figures for highs and advanced highs that you are looking at are from 2014 and they relate to the old, non-curriculum for excellence versions of the courses. Those figures had, over several years, shown a heart-warming rise in the number of pupils doing sciences.

The figures that give us concern are those for the new curriculum for excellence courses, which have only reached secondary 4 level in schools. Having looked at those figures and tried to compare like with like across the Scottish credit and qualifications framework at levels 3, 4 and 5, which equate to the old standard grade, we are concerned that we are seeing decreases in all the sciences.

As you say, the drop is almost 9 per cent for biology and chemistry; there is a little less of a drop for physics.

Mary Scanlon: So you are picking that up now. That explains why you are getting the early signals of a decline—

Dr Beveridge: Of a change, yes.

Mary Scanlon: The figures in the SPICe paper relate to past entrants, so in fact both sets of figures are correct. We now understand the figures, and we will look in more depth at the alarming figures that you have given.

Professor Brown, you say that you are supportive of curriculum for excellence. We all are, but we have heard stories from the Wood commission and from Dr Lakin today relating to hands-on skills. Is your main concern that reduced numbers are going forward in the new curriculum for excellence or is it that the qualifications that

pupils are getting do not involve enough hands-on work and practical skills and are—dare I say it?—a watered-down version of what used to be a science qualification?

Your information states that school pupils no longer have the skills for employment and higher education, that the amount of practical work has diminished and that the ability for pupils to develop hands-on skills has diminished. Are you saying that, in addition to your concern about declining numbers, we are no longer preparing pupils for employability or for higher education?

Professor Brown: Our main concern is to ensure that the reformed system that we are now working with produces the best that it can for the future.

Mary Scanlon: We all want that.

Professor Brown: Of course, but the decision to have no pilot work on those reforms, together with the fact that there is no independent evaluation and no baseline data means that we do not know what is going well and what is not going well, or what we should do about it.

Mary Scanlon: Am I right to say that you are concerned about the quality of the practical experience and the ability of school pupils to pitch into employment and higher education?

Professor Brown: Indeed we are, but our concern is that we should really understand what is going on at the moment. The sorts of things that you are suggesting that we should be concerned about—

Mary Scanlon: I am only asking questions on the basis of your evidence.

Professor Brown: The implication of your questions, then, is that we should be concerned about the long term. Indeed we should, but we should also be concerned about such things as whether the SQA assessments and qualifications are doing what we need them to do in order to ensure that the curriculum for excellence is achieving the things that it set out to achieve. That is our concern, as a group of royal societies.

We have to think about what we are going to put our efforts into. We need to do some work on the kinds of things that we have brought to your attention, such as resources and the confidence that primary teachers have in their ability to do what is needed, and that is what we have focused on. We have not yet reached a set of recommendations on what ought to be done that we could bark at the committee during the meeting.

The committee has shown that it is concerned about who has the responsibility for doing something about funding better resources. Central

Government has responsibility, but it tells us that all of that is devolved to regional authorities. Regional authorities tell us that almost all of the money for education—80 or 90 per cent—is devolved to schools. Then we go and ask the schools, and they say that 90 per cent of what they spend goes on teachers and that they have no control over that because they have to pay according to the national scales. Some schools even say that they have to obey decisions that have already been made on procurement, so they have no freedom to speak of to take on that responsibility.

We are not here to tell the committee how that should be done. We are simply here to say that the issue needs attention, whether from central Government or from local government. All that we can do is to offer the evidence that we have and say that it would be a very good thing if more extensive, overall evidence was commissioned. You have to see the position that we are coming from.

Iain Gray (East Lothian) (Lab): Although in some ways the discussion has moved on, I want to follow up on the point about the quality of data and available evidence. That has been a theme of the questioning, which is not surprising because the availability of data is a theme of the LSG submission.

Stuart Farmer talked about the SEEAG recommendations on tracking progress in STEM subjects and how they were not accepted. The submission mentions: the collection of establishment and vacancy statistics ending and that there is now no information on teacher vacancies; a lack of information on the level of science qualification of primary teachers and whether they have highers in a science subject or maths; and also the withdrawal of Scotland from international comparisons—the trends in international maths and science survey, as well as the progress in international reading literacy study.

You have talked a lot about the data that is available. Is it fair to say that, when it comes to both inputs and outputs, the data available is reducing—it is not getting better, but worse—that we know less about what is happening in science teaching in our schools, and that that is why you have tried to plug the gap with your survey?

Professor Brown: Yes, I agree with that. I have already made a comparison with the reforms that we went through in the 1960s; let me shift up to the 1980s, to the reforms to standard grades. There was much more concern then with having pilot studies and continuing professional development, which were carried out before and during the reforms that were being introduced, and not as a kind of afterthought after difficulties were identified by teachers.

We have a problem with not having the right data. Perhaps I should turn to Kate Farrell, who is from computing science. We all agree that computing science is centrally important in ways that it used not to be. We have concerns about the number of teachers as well as the distinction between information communications technology, which is quite often readily taken on, and computational thinking, which we think is absolutely essential for the future of our society. We also have difficulty in getting data that we need. May I ask Kate to contribute to the discussion?

Kate Farrell (Learned Societies Group): We have carried out two surveys, one this year and one two years ago. This year we discovered that we have lost 109 computing teachers over the last two years, so that we are now down to about 650 computing teachers in Scotland for secondary schools. That equates to a 14 per cent drop. In the five years before that, we lost 100 teachers. That is, we have had a drop of 100 teachers over five years and then another 109 teachers over the last two years. That means that 12 per cent of our secondary schools in Scotland do not have a computing teacher at all.

When we asked schools why they do not have a computing teacher and how they are teaching the curriculum if they do not have a computing teacher, many respondents were confused about the difference between ICT and computing. They said that they were teaching ICT across the curriculum. ICT should be taught across the curriculum, but ICT is about how to use the technology and about the use of technology within teaching. It is about how to use iPads or laptops or phones. We are concerned that we are not teaching how to programme those devices. We are not teaching how they work. We are not teaching computational thinking, the core skills of understanding processes, methods and modelling.

In terms of the numbers staying relatively static, we have been hit fairly hard by the changes from standard grades to national 5 qualifications. Pupils were generally taking seven or eight standard grades, but they generally take five or maybe six national 5s. That reduces their subject choices. Their column choices tend to be maths, English, a modern language and a science, and then there is a column of everything else. Although it is a rigorous academic subject, computing science is generally bundled in with practical subjects. For example, at one school it was competing with cake decorating and car mechanics. Those are valid subjects, but they are neither rigorous academic subjects nor scientific subjects.

We are finding that there is a lack of computing teachers in the system. We are not getting enough computing teachers trained up, which is one of our

problems. Ten out of 32 local authorities said that they were having problems recruiting computing teachers. Teacher training is happening only in Glasgow now, where the universities of Glasgow and Strathclyde offer professional graduate diplomas in education in computing. We are not reaching our target. This year there are only 21 student teachers training as computing teachers, plus two at the University of Stirling each year. That does not reach our target, and it does not even reach the extended cap that the universities were allowed. We are not getting enough teachers into the system, which is then causing problems with recruitment.

10:45

So far, the numbers have been staying relatively steady for higher computing each year, but we need to train a massive number of further teachers. ScotlandIS, our industry body for information technology in Scotland, is saying that we need to train up more computing teachers, that we need to train up more people in computing and that we need to get more people through university, so that we get more people into the IT industry. If we could get tens of thousands more people into our industry, our economy could boom. At the moment, however, there are not enough people coming through to meet the demands of the industry.

ScotlandIS is carrying out an annual industry survey this month. Seventy per cent of the respondents to last year's survey said that they were planning on recruiting but were struggling to get staff, or they were having to go outwith Scotland to get new members of staff.

Chic Brodie: In the other committee that I am on, we have been investigating the creative industries, including the video games industry. Here we have a sexy industry, yet you cannot recruit those who are needed to support it.

I return to my original question. Where does the responsibility lie? How much responsibility do you have—not you personally, but the societies and so on—for attracting people? There is a huge, very attractive industry, which is hugely important, yet you are raising your hand and asking what we are doing and what Government is doing about it. What are you doing about it?

Kate Farrell: Computing at school Scotland is working with Skills Development Scotland, which is planning a publicity campaign. That is a core part of its skills investment plan for IT, and we are working with SDS on that.

As regards increasing demand and skills, we had Government funding a couple of years ago for part of the professional learning and networking for computing—PLAN C—project. We are

providing continuous professional development, networking and support for computing teachers. There are only 650 computing teachers, and we are working with more than 50 per cent of them already.

On upskilling and learning new pedagogies for teaching computing, we have not generally had any professional development as a nation since the 1980s, when a lot of teachers were converted over into teaching computing.

As a nation, we are very rare. We are one of the few countries in the world that asks its computing teachers to have a degree in computing. We have had that for a long time now. We are one of the few nations that provides teacher training in computing. We are one of the few countries in the world with a curriculum for computing at primary level. I really hope that we do not squander that and that we build on it. A lot of countries are looking at us with envy at the moment.

Stuart Farmer: I will follow up on some of Kate Farrell's points. All the learned societies represented here are doing quite a lot through various initiatives—Bill Beveridge spoke about some of them earlier—to recruit young people into STEM subjects and also to recruit teachers into some subjects.

To take a current example, the Institute of Physics is in the process of putting together a campaign for suitable undergraduates to enter the teaching profession, so as to address the teacher shortage in physics. Although I am from the Association for Science Education and the Institute of Physics, I also sit on the STEM education committee—STEMEC—whose work follows on from the SEEAG report that I mentioned earlier. The supply of an adequate number of teachers is of concern to STEMEC.

Last year, we had a meeting with John Gunstone, who deals with teacher workforce planning at the Scottish Government. The figures for 2012-13 showed that the target intake for the computer science teaching PGDE was 42. However, the actual intake that was achieved was only 17, which is obviously a shortfall of 25. That gives a replenishment rate of about 2.8 per cent. In other words, at the rate at which PGDE students have been getting trained, it would take 36 years to replenish the existing workforce. As Kate Farrell said, that is insufficient. There are schools that do not have a computing science teacher at all. The four subjects with the lowest replenishment rates are computer science, physics, chemistry and business studies.

As I have said, the Institute of Physics is very concerned that we in Scotland do not go down the route that we see being taken in England, for example. Many secondary schools in England are

without a physics teacher. So far, we have been more or less able to avoid that. We are not yet in the situation in which those in computer science find themselves, but there is definitely a job of work to be done—not only by the likes of the learned societies—to try to ensure that teaching is seen as a valuable career and that we attract people into it.

It has been reported by various sources that we face a situation in which job opportunities in the physical sciences, engineering and computing are very good, as Chic Brodie said. Industries such as the creative gaming industry are very sexy and are attracting potentially very good teachers away from teaching. As a result, we are concerned. We would like to get better evidence on the longer-term impact that that is likely to have on the future workforce. If we lose our talented young people to other industries, we will lose the capacity to train the future workforce that the country will rely on to ensure that we have a good science and technology-based knowledge economy so that the country is successful in the future.

Siobhan McMahon: You mentioned replenishment rates. I know from my own patch and the area that I represent that some physics teachers who wished to retire have had to keep on because there was no one to take their place. If they had retired, physics would not have been offered in those schools. Do you have facts and figures on how often that is happening, given that you said that you do not want to go down the English route?

Stuart Farmer: Unfortunately, we have only largely anecdotal evidence. That is one of the things that we would like to see independent evidence on.

I am sitting here not teaching my national 5, higher and two advanced higher physics classes that some would say I ought to be teaching today. A retired physics teacher whom I managed to secure is covering my classes today. That is one anecdote, but it is very typical.

Professor Brown: As a retired physics teacher, I am a little concerned that Stuart Farmer might get me along.

Stuart Farmer: I know that Iain Gray said that he has played a small part in the history of physics teaching; I assure him that I would be delighted to have him on the team.

Iain Gray: I assure colleagues that my General Teaching Council for Scotland registration has lapsed.

The Convener: Thank goodness for small mercies, Iain.

Unfortunately, I think that Mark Griffin's question has been covered by his colleague Iain Gray: they

can talk about that afterwards. I know that Liam McArthur has questions that he wants to ask.

Liam McArthur: I want to move on to the secondary sector. Professor Brown has made the support of the learned societies for the roll-out of the curriculum for excellence very clear, and she was right to allude to the cross-party consensus on the matter.

The committee is familiar with some of the concerns that have been expressed about the implementation of the curriculum for excellence, but I was struck by the stridency of concerns that were expressed in the written evidence. One of the main conclusions from the learned societies group's survey was that the implementation was "condemned" as being

"incoherent, amateurish and rushed, causing stress among teachers and pupils."

The submission goes on to say that assessment requirements were

"poorly explained, inadequately implemented nationally and undermining the confidence of both staff and pupils".

I want to tease out whether you think that the teaching profession for the STEM subjects has been disproportionately impacted by the roll-out of the curriculum for excellence and whether the impact on morale in the STEM areas has been more pronounced than it has been across the board. Are you seeing that problems have emerged in certain schools, but less so in others?

Professor Brown: I am probably going to give an unsatisfactory answer: I do not know, because we have not looked at teachers of other subjects.

At the Royal Society of Edinburgh, we have heard concerns about history, geography and so on expressed in small groups, although those are not always the same concerns as STEM teachers have. There are probably distinctive things about STEM.

I remind you that, as we made clear, the data collected in 2014 was when schools and the SQA were going through national 4 and national 5 for the first time. It would be surprising if there were not matters that made people nervous and set them on edge. However, an important issue that we are picking up that has been going on for several years is that the concerns from a number of different sources, including parents and teachers—we work with parents organisations, too—are not properly dealt with.

I suppose that one of our hopes is that attention will be paid to that, so that Government, its agencies and others involved will say, "Look, we are getting some systematic evidence to say that there is a concern about this area. What can be done about it?"

After I gave a talk at Our Dynamic Earth, I was rather flattered but also rather embarrassed when a teacher stood up and said, "Thank you for taking notice of us." I was embarrassed because I should not be pleased about that. We must take account of the concerns of parents and teachers. To do that, we need to find the evidence.

We have done some rather small—on a world scale—pieces of inquiry. Scotland has had a magnificent name for education, but it should be looking at evidence of how things are going in classrooms—what is going wrong and what is going right—and building on that. There is the opportunity to do that work because of the increased emphasis on continuing professional development, but it must be done systematically.

Liam McArthur: That was very candid. We are returning to the issue of data availability that Iain Gray mentioned. The Royal Society of Chemistry submission suggests that the programme for international student assessment—PISA—studies show that Scotland lags behind a number of international competitors, including Singapore, Germany, Poland, Vietnam and the Chinese regions Shanghai and Hong Kong. Therefore, there is evidence on which I suppose the Government and others with a stake could justify decisions to provide additional support, were it needed.

You have just talked about the need for better communication between teachers and those with responsibility over school management and other such matters. Others have suggested that, in areas where there are particular problems, whether that be computing science or physics, those subjects should be deemed sufficiently important to get key worker status and an additional supplement to try to retain people in the sector or recruit in the face of competition from the creative gaming sector or wherever it might come from.

Do you have any thoughts about what might address the problems that have been flagged up in the report and the concerns coming out of the PISA findings?

11:00

Professor Brown: We have to be careful about interpreting international attainment data. Over the years, there have been lots of reasons why Scotland has come out better or worse than perhaps it should. One has to consider that carefully and not use the data wildly.

Personally, I think that we have to move forward first by agreeing that we are moving into a new world in all sorts of ways, that we have introduced a radical set of reforms and that we are pleased that people round the world accept that they are

radical reforms and that we might be leading the way. However, we have to consider the implications of those reforms. We have to see them as leading to a radical new approach to what happens in school. For example, in the curriculum for excellence, there is the notion of focusing not only on effective learning but on responsible citizenship and developing young people's confidence and ability to contribute effectively to society. However, we have no idea whether we are actually including that in the assessment. The SQA will say that it is including those sorts of things, but there has not been a study to show that that is the case.

We have to accept that the new approach will take a few years. We cannot simply compare this year with last year. We have to look to the year after this year and, given the experience of what happens next year, which might be different, our approach might end up being different. However, we cannot just let it go on without examining the impact and considering what that tells us about what we have to do for the future, given that we have some very good aims and goals.

Liam McArthur: Would it be fair to say that, from your perspective, a successful outcome of the work that has been done would be a commitment from the Scottish Government to developing longitudinal studies or mapping exercises that will give us a clearer understanding of what is happening?

Professor Brown: That is important. There would, of course, be arguments and stated positions about what was the priority. The issue involves looking at priorities. If I had to make one criticism, though, it would be that we have been too busy asserting the successes that we have had in the reforms but, when we look for the evidence for that, we do not know where it is.

Siobhan McMahon: I will ask about the Wood report and the commission for developing Scotland's young workforce. That report says:

"Tangible steps to improving the popularity of STEM education are only achieving limited success."

The Scottish Government's response to it says:

"Employers and schools need to develop strong two way partnerships—partnerships that deliver improvements to teaching and learning and bring real-life context into the classroom, particularly in relation to science, technology, engineering and mathematics".

Do you believe that that approach will lead to an improvement in the funding for teaching? Do you see any tangible results arising from the Government's response to the commission?

Professor Brown: I am not sure that I can answer your last question. It seems to me that we are at one with Wood in so far as we are looking for ways forward. The word "partnerships" is

loosely used. We have ourselves been involved in partnerships that have turned out not to be partnerships at all but have instead simply been an arrangement that allowed somebody to say, "Our partners"—the royal societies or whatever—"support us," even though we might not actually have been given any information about what that thing is.

Although in principle and conceptually partnerships are, of course, always necessary, we have to be clear about what that means. Not so long ago, we had a meeting with Education Scotland at which it listed its partnerships. The list went on and on. We asked whether it had evaluated which of those partnerships it should be pursuing and we found out that it had not. Education Scotland told us that it was not a research or evaluation organisation. That is quite right, but the trouble is that we need to work out how we decide what will constitute a partnership, how we get people on both sides to take responsibility—partnerships are not takeovers—and how we maintain accountability for that.

Others might want to offer their opinion, but I would say that, when we talk about partnerships, we must be clear what the responsibility is and how accountability will be worked out.

Kate Farrell: As far as computing is concerned, there is certainly a need for more varied opportunities for young people. We do not want to focus on training a generation of software engineers. The opportunities that are provided need to be far more varied, whether they involve going through further education college, going directly on to training schemes or working with employers.

We have started doing a bit of research into what non-information technology industry employers would require of their employees. It is evident from our initial research that much of what they are coming up with is to do with core computational thinking skills: the ability to see a bigger picture, the ability to break down a problem and the ability to model a solution for the problems that are encountered.

We would like to work with Education Scotland—we are in discussions with it on this—to update the broad general education that three to 15-year-olds receive by ensuring that, as far as computing is concerned, the curriculum includes more computational thinking and goes beyond just looking at computer games as a context, which is what it currently does.

Dr Beveridge: We certainly think that there is great value to be had from industry becoming involved. Industry has a huge contribution to make in promoting the STEM subjects and working with schools. I mentioned the chemistry at work

programme, which we fund. We have found it to be extremely effective in allowing people from industry to share the excitement of their subject and their experience with school pupils. That is very worth while.

Stuart Farmer: Much is already being done in this area. It is clear from recommendation 12 of the Wood report on developing Scotland's young workforce that STEM should be at the centre of the education of our young people.

I agree with Sally Brown that the work must be carried out in a structured way in partnership with other organisations. Much of what is done at the moment is on a relatively ad hoc basis. As a result, less value is obtained from many of the partnership arrangements than could be the case if there was a more structured framework that involved follow-up with independent analysis, feedback and evaluation. Industry organisations such as the learned societies definitely have a part to play, but there must be a structured framework that maximises the benefit for all partners in the organisations.

Dr Lakin: Members might be aware of the STEM ambassador scheme, which involves representatives from higher education, research and industry going into schools and working alongside children. That is a tremendous way of raising the profile and awareness of working in science, and it is to be applauded.

Siobhan McMahon mentioned funding, but we have to be a wee bit careful on that. Recalling what Kate Farrell said about the difference between training for work and what education is about, we have to remember that there are different agendas. Part of what we are doing in education is preparing pupils for work, but there is also the wider agenda of preparing them for life in society. The funding side could hold us to ransom if we are not careful.

Siobhan McMahon: Given the report that the group has given us and the challenges that you foresee in the education system, do you think that you could implement the recommendation in the Wood report just now?

Dr Lakin: I would not like to comment directly on that. I am not sure.

The Convener: You do not have to comment.

Professor Brown: It depends on what you mean by "just now". If you mean by Monday afternoon, then no, no, no. [*Laughter.*] However, a lot of difference can be made over a few years.

Siobhan McMahon: What I am getting at is whether you have the resources. You have given us a challenging report and you are setting out all the things that you think require more support. You have now been given another challenge by the

Wood report, which the Scottish Government is endorsing and which others are signed up to. Can you implement it with the resources that you have?

Professor Brown: You are the Government.

Siobhan McMahon: No, I am not.

The Convener: None of us is.

Siobhan McMahon: If I go back to the Government, what should I say?

Professor Brown: We are not trying to say that one specific thing is much more or less important than others; we are trying to help you by laying out some of the landscape. Of course, one can never do everything that one wants to immediately. One has to have priorities, and one has to go public with the priorities and listen to the debate about that. However, our group has not tried to come to an agreement on the priorities. The main reason why our group came into existence was that the individual learned societies in the different sciences—and we include engineering, of course, although we have not got anybody from engineering here today—found that the societies were not having the impact on public policy that they wanted to have. They thought that, if they could get together, there were some general things that they could collaborate on and perhaps they would have a louder voice. We have done that with the learned societies group.

I would not want to speak for the group. However, I personally would put a lot of support in the primary sector. I think that the support that the primary sector has had in the past and the priorities that have been put on it have not been enough. I am not sure whether we said this in the report, but we have tried to persuade the General Teaching Council for Scotland that people who go into primary education should have much better qualifications in science than they currently have. I do not know whether we will succeed in that, but that is one of the things that I think is important.

The kind of campaign that the Royal Society of Chemistry has at the moment is very important, and Kate Farrell has told us of the instance of the need to promote changes in computing studies. However, I am not in a position to give the committee a list of what I would put forward as the first things for the country to take on. I would simply say that those issues must be on the agenda somewhere.

Gordon MacDonald: You have just turned the conversation to the primary sector, which is exactly what I want to ask you about. When I read the report, I was concerned about a couple of issues that are highlighted in it. The first is under "Funding for science". In paragraph 7, you state

that, among the Scottish primary schools that were surveyed,

"A number indicated that per capita science spend in 2013–14 was nil".

What was that number and are you able to name the schools? If you do not want to name the schools, are you able to identify whether a nil spend was widespread or related to one local authority area? What was the situation?

11:15

Stuart Farmer: The number was very small. We are not in a position to identify the schools.

Gordon MacDonald: When you say "very small", do you mean that it was one or two?

Stuart Farmer: Yes, one or two. The majority of schools spent something on science but, as you can see, the average figure—and, indeed, the maximum figure—is still small. The number of schools that identified a nil spend was very small.

Gordon MacDonald: Were they not spending anything because they could not identify how much of their budget they spent on science, or was it that they did not teach science at all?

Stuart Farmer: Our survey did not have a question that could identify whether it was because they did not teach science or because they had not identified any spending for it in that financial year. Either reason is possible.

Gordon MacDonald: So they could be teaching science but, if they are going to Our Dynamic Earth or the Glasgow science centre, registering those as trips rather than as science.

Stuart Farmer: Perhaps. Again, we do not have evidence for that. It is the sort of thing on which we would like more independent evidence and information to be gathered. Our survey was not able to identify that level of detail.

Gordon MacDonald: Okay. My second concern—

The Convener: Sorry, Gordon, I have a small supplementary. I have to say that that jumped out at me as well. Do the witnesses think that it is likely that any primary school in Scotland is not teaching any science at all?

Dr Lakin: We have to be careful with that question because we do not have any independent evidence either way. However, we have anecdotal evidence. I see students in primary schools as part of my job and the amount of science that is done seems to be a lottery depending on the expertise in the school. We need more information about that. We would welcome that.

The Convener: I accept that. It jumped out at me and I am sure that Gordon MacDonald asked about it for the same reason. The report says that, in a number of schools—it turns out that it was one or two—the spend was nil. It seems to me more likely to be an anomaly in the survey than a fact that there are primary schools in Scotland where no science at all is taught. It might just be that it is not identified as a budget spend.

Stuart Farmer: There are degrees of what different people would identify as science. For instance, one of the concerns is to ensure that the quality of the science experience in our primary schools is good. That is part of the reason why the Royal Society of Chemistry supports the campaign for a science specialist.

Again, the learned societies group does not have detailed evidence on the matter but, anecdotally, we could identify concerns. In some schools, a teacher might be doing a science topic about the solar system and the universe and the activity is creating models of the different planets in the solar system out of papier-mâché around balloons. That is, in essence, just a craft or art activity in which the pupils paint balloons different colours to represent the different planets without doing any deeper work on the scale of the universe and the mathematics behind the relative sizes and distances, or what I would recognise as scientific activity. However, it could still be interpreted and identified within a teacher's work plan as a science-based activity.

Without doing some good-quality research to identify the specifics of the activities in a bit more detail, it is difficult to identify the quality of science activity that goes on in many of our schools.

The Convener: Thank you. Sorry, Gordon.

Gordon MacDonald: That is fine, convener.

As I was going to say, my second concern relates to paragraph 12, which is in the section on classroom facilities, health and safety and outdoor space. It says:

"45% of primary schools report having no access to safety equipment".

Obviously there are health and safety regulations that deal with such matters, but are you saying that schools are teaching science in ignorance of health and safety requirements and are therefore putting pupils in danger or are you saying that no practical science lessons are taking place? After all, 45 per cent is quite a substantial number, albeit that the sample size of 2 per cent was small.

Stuart Farmer: Most of the outcomes that were reported from our survey work were broadly in line with my own personal expectations but, of all the outcomes that we got, I have to say that I did not expect this one. I am quite alarmed that so many

primary teachers seem to be forthcoming about the fact that they do not have adequate access to safety equipment, and I think that the issue ought to be followed up with more investigative work. Again, the survey did not go into sufficient detail to indicate that their lack of access to such equipment meant that they were doing nothing or that they were doing things without the appropriate health and safety advice.

Gordon MacDonald: But that is quite a serious accusation, because pupils could be being put at risk. If you are saying that of the 39 schools that you surveyed roughly 17 or 18 of them—45 per cent—have these genuine concerns, it is your duty to inform the committee in writing of what those schools are, because we will have to address the matter with local authorities. We cannot have a situation in which you highlight serious concerns about schools having no access to safety equipment and we as a committee sit here and do nothing about it.

Stuart Farmer: We are simply reporting what has been reported to us by teachers.

Professor Brown: I should point out that we assure the schools of their anonymity.

Gordon MacDonald: But you are claiming—

Professor Brown: We are not claiming; it is the teachers—the schools—who are claiming.

Gordon MacDonald: Okay, but your report is claiming that 45 per cent of primary schools—albeit 45 per cent of a very small sample size—have no access to safety equipment.

Professor Brown: I still have to challenge you on who is claiming what. We have established no validity about the finding; all that we are saying is that 45 per cent of the responses from primary schools said that. We have assured the schools that they will remain anonymous.

Dr Beveridge: We should also remember that teachers are only answering the question that was put to them. I would have to check its exact wording but, basically, they were asked, “Do you have specific science safety equipment?” You can do lots of wonderful hands-on science in a primary school without requiring safety equipment, so in no way would a teacher who had answered the question be necessarily admitting that they had put any pupils at risk whatsoever.

Gordon MacDonald: Given your previous comment that there are so few teachers in primary school with a science background, how would the teachers who had answered the question know whether they actually had the correct science equipment in place to deal with health and safety requirements if they have no background in science?

Professor Brown: I regret that our research was not sophisticated enough to give you an answer to that question.

Dr Lakin: If we dig deeper into what paragraph 12 says, we see that it refers to

“tongs, sand trays, heat mats and goggles”.

Of those, I would expect to see sand trays in a primary school. I would not necessarily expect to see tongs, heat mats and goggles, because the practicals that the pupils would be doing would not necessarily involve the use of those things. I think that what might be coming out is a misunderstanding about the types of practicals that teachers would be doing, and we should not necessarily assume that they are doing them. I think that paragraph 12 is giving us a slightly different story.

The Convener: Just to confirm, then, we are not saying that primary schools are necessarily being inhibited from teaching the lessons that we want them to teach because of a lack of safety equipment. Is that right?

Dr Lakin: Yes. I would not necessarily expect them to have tongs, heat mats and goggles—

The Convener: No, neither would I.

Dr Lakin: As you said, they can still carry out a range of wonderful experiments—in fact, I would advocate that they do that rather than trying to go down the route that you mention.

The Convener: No, indeed. Is it possible that there was a misunderstanding by the respondents?

Dr Lakin: Quite possibly.

The Convener: I am not saying that there was—I am just wondering.

Liam McArthur has a supplementary.

Liam McArthur: My question is on a point that Gordon MacDonald touched on and arises both from the exchanges about safety equipment and from the explanation that a school project on the solar system might have some level of scientific input but might simply be an arts-and-crafts exercise. That underscores the importance of having at least one person in a school who can give other colleagues confidence that such projects can have a scientific input. I would draw that conclusion from both those paragraphs.

Dr Lakin: Absolutely. That reinforces what Professor Brown said earlier about raising the entry level to initial teacher training for potential primary teachers.

Liam McArthur: Is it realistic to do that across the board? I have had conversations with colleagues about that in the past. The

constituency that I represent, Orkney, has a number of very small primary schools, and someone might have a role that spans numerous primary schools.

Dr Lakin: Yes—I think that Bill Beveridge might want to say something on that.

Dr Beveridge: This is one area in which there is complete agreement across the board. The evidence is very strong. Education Scotland's "The Sciences 3-18" report and our survey show that a prime issue is whether there is access to someone in a school—or in a neighbouring school; Liam McArthur makes an important point—who has the confidence to address science teaching and to advise others on science teaching in primary school.

Liam McArthur is quite right about small schools; Scotland has almost 11,000 schools that have a school roll of fewer than 50. Our campaign is advocating for science subject leaders: people who are confident in science. It could be someone who has a science degree background, but all that the Royal Society of Chemistry recommends is that someone has a science higher or equivalent training that they have picked up during initial teacher training, or experience from an extensive career, to enable them to advise others in their school on science issues—or, in more rural areas, where schools are smaller, to be on hand to advise people in neighbouring schools.

Liam McArthur: Again, though, we presumably need to know where we are at present. As I understand it, the statistics on the profile across the current teacher population are not necessarily that robust.

Dr Beveridge: No. We have tried hard to assess how many teachers might already have a science higher or how many are entering the profession with those qualifications, but we have not been able to obtain those statistics. We would very much welcome any kind of initiative to try to pin down harder figures.

The Convener: I just want to check something that I may have misheard. Dr Beveridge, did you say that there are 11,000 schools in Scotland with a roll of fewer than 50?

Dr Beveridge: Close to 11,000.

The Convener: Is that right? Is it 1,100, maybe?

Dr Beveridge: It could be 1,100.

The Convener: I would check your maths, Dr Beveridge.

Dr Beveridge: Numeracy is important, too. [Laughter.]

The Convener: We will double-check that. It did not sound right to me.

Professor Brown can go next.

Professor Brown: I just want to remind the committee, given that we are talking about how we might be able to get the science expertise that we need in schools, of the foreign languages developments in the 1990s. A number of different models were used, including developing the modern languages skills of primary teachers, or of some primary teachers, and bringing in secondary teachers. That is the sort of thing that we might be looking for. We could explore what different models there are for the provision of science in primary schools.

The Convener: I agree, but I wonder what your view is on another point. I was looking at an article in *The Herald* on your report and the issue that we are discussing today; the point also came up in Iain Gray's debate on the subject. The article says that a Government spokesman said:

"We provide direct funding of £900,000 per annum to the Scottish Schools Education Research Centre".

The purpose of that is to support teachers and increase their confidence in the science areas that you have been talking about. The spokesman went on to talk about Education Scotland's development of a national STEM project, which is being piloted, and the intention is to roll that out. Is that not what you are calling for? Is it not beginning to happen?

11:30

Professor Brown: Your first question was about SERCC, which is a very effective organisation that has been around for some time. One of the really good functions that it fulfils is an independent evaluation that shows how good its work is. It suffers in the sense that it cannot expand enough, but that is just a question of resources. The SERCC model has shown itself to be very good indeed, and it would be great if it could be extended across the whole country more effectively.

The Convener: As I understand it, the £900,000 research project that we are talking about operates in about half of the authorities.

Stuart Farmer: I think that it operates in 15 of the 32, but I would qualify that slightly with the fact that within each local authority it might just be operating in one cluster of primary schools. It might just involve a small fraction of the total primary schools in a particular authority, so there are issues of scale involved in the project.

Professor Brown: Your second question was about Education Scotland. I do not know anything about that particular development, or at least not

in enough detail to comment on it. I do not know whether anyone else knows enough about it.

The Convener: It is currently operating in four local authorities—the spokesman did not say “pilot”, but I am using that word; I assume that that is what is going on—and the intention is to roll it out further across the country.

Professor Brown: If it does the job.

The Convener: Well, I was asking, but maybe—

Professor Brown: I am afraid that I do not know.

Stuart Farmer: I am aware of the project and which four local authorities it is taking place in, but we do not have any evidence from it.

Mary Scanlon: Mathematical skills were highlighted in the last exchange—we will not let you forget that—but we have not said much about maths today. Kate Farrell did very well on computing, but I am not sure who is speaking up for maths. Is the teaching of mathematics a priority in schools? I highlighted that there has been an increase in presentations for higher and advanced higher. In the grand scheme of things, is maths a priority?

Professor Brown: Yes.

Mary Scanlon: Would you be as concerned as I am that, although there has been a fall in the number of teachers in various science disciplines, the highest fall in the figures that I have in front of me, which may not be totally complete, has been in the number of mathematics teachers? In 2014 we had 314 fewer maths teachers than we had in 2009. That has not been covered today. Should maths teacher numbers be a priority? Why is that fall happening and does it give you cause for concern?

Professor Brown: This is an off-the-cuff answer to you, because we do not have mathematics in our group of learned societies.

Mary Scanlon: Oh dear. Maybe that needs to be corrected.

Professor Brown: Maybe it does. We will have to take that back.

Am I concerned? Yes, I am. I do not know whether the loss of maths teachers is worse than the loss of computing teachers, proportionally.

The Convener: Dr Lakin wants to come in.

Dr Lakin: I just want to pick up on what is being said about the importance and significance of maths. Yes, there is concern across the board. We must remember that STEM stands for science, technology, engineering and maths. Maths is part of the whole STEM agenda, and in particular it is

the application of maths in the interdisciplinary side, where all those subjects interweave, that we need to remember.

Although we do not have representatives from a maths organisation in the learned societies group, maths is applied throughout all the subject areas that we look at. It is not just a case of teaching the subject; it is a case of looking at how it is used in the various disciplines, as well.

Mary Scanlon: Thank you for putting that point on the record.

We have been talking about partnerships this morning. To what extent do schools have links with universities, colleges and industry? Gordon MacDonald has mentioned the shortage of equipment and so on. Are there partnerships for utilising science and teaching equipment? Do businesses and universities donate science equipment to schools? Is it worth developing such partnerships further for the better utilisation of the equipment that there is?

Professor Brown: Universities Scotland has published some things on that. There is a quite extensive—albeit not systematic—pattern of partnerships. For example, for many years Heriot-Watt University has had some very close partnerships with schools in engineering, physical science, mathematics and so on. There are many cases where equipment is lent—I am not sure whether it is given—and where school pupils go into universities to use their facilities.

Of course, schools in the central region of Scotland are likely to benefit much more than those that are out in some rural place. However, the University of the Highlands and Islands, with its college structure, has done that work in some of the more rural parts of the country.

One of the big questions is how to extend those partnerships to all schools, either by getting young people to travel to other institutions or, as probably happens more often, by getting people from the higher education institutions to travel out to schools.

Mary Scanlon: So there is scope.

Stuart Farmer: That follows on from a point that I made earlier about the fact that a lot of the partnership initiatives are ad hoc in nature. As a nation, we ought to be cleverer in how we develop partnerships. In particular, we should be looking to have some provision in outlying rural areas, so that our young people there have the same opportunities as those who live down the road from a higher education institution. That would mean looking at the situation in a systematic, Scotland-wide way.

Mary Scanlon: I am pleased to hear that, given that I am an MSP for the Highlands and Islands.

I have a further question that has not yet been covered today. We have spoken about spending, and you have mentioned the autonomy of local authorities and so on. At page 2 of your submission, you say that the per capita spend on science in primary schools was about £1.62 in Scotland and £2.89 in England. Your figure for secondary schools in Scotland is £7.33 for 2013-14. The figure for England is from two years earlier, but it is still greater—it is £3 more. Is the spending per pupil the main issue? Are the outcomes in England so much better? What is the result of that higher spending per capita, and is that the main issue today?

It does not always have to be Sally Brown who answers—she has already worked very hard this morning. Perhaps someone else could give her a break.

Stuart Farmer: There are issues with that question, in that we do not have much direct evidence.

Mary Scanlon: But you did quote those figures—they are your figures.

Stuart Farmer: Indeed—we have the evidence for those figures. Part of the reason why the learned societies group wanted to conduct the research into resourcing was that the equivalent group based down in London—science community representing education, or SCORE—had conducted a survey in England. The learned societies headquarters down in the London area saw fit to support the learned societies group in conducting a similar survey for Scotland. We were interested in making a comparison.

We have conducted that study and are presenting the outcomes. The engagement of Scotland in international studies is one of the main ways in which comparisons between different countries are made. As has already been said, Scotland withdrew from TIMSS, which was the main study looking at upper primary and lower secondary comparisons between Scotland and England, which means that we have no independent evidence on which to make a comparison.

Mary Scanlon: So although you have the figures, you do not have the results in terms of passes and employability.

Stuart Farmer: Historically, one of the differences between England and Scotland has been that, since the introduction of the national curriculum in England in the late 1980s, science has been one of three core subjects along with mathematics and English. That has given greater prominence to science within the curriculum in England than it has enjoyed in Scotland. There are some consequences—perhaps unintended—of

that, which mean that in England science has enjoyed greater status.

The Convener: You will be pleased to hear that I have just one final question. We have gone on longer than I anticipated, although I am sure that that is a good thing.

Professor Brown mentioned that an underlying theme is to build a better evidence base and review what is going on. Are you aware that the Organisation for Economic Co-operation and Development is reviewing curriculum for excellence this year?

Professor Brown: Yes, we are.

The Convener: Are you involved in that? Are you in any way reassured by that review?

Professor Brown: It is a review, but it is not an evaluation. We are described by the Government as a partner in that review, although it has not worked out terribly well so far. The OECD is coming twice, the first time in February.

I am sorry, but I have just realised that I am no longer talking as a representative of the learned societies group, but as a member of the Royal Society of Edinburgh. We are expecting that the learned societies group will have an input. However, the real collection of evidence will come in June; I forget when the report will be published, but my guess is that it will be at the end of the year.

There is a very ambitious background paper, which is being put together by the Scottish Government. We have had the chance to comment on an early draft, which we have done. We do not know what impact we have had, but we will find out by the time that we meet the OECD in February. Therefore, if you ask us in a couple of months, we might have more to say, but we will have to wait until the end of the year—December 2015—until we really know.

The Convener: The evidence session has lasted for almost an hour and three quarters, so we have had a decent crack at it. Thank you for indulging us this morning and for both your written and oral evidence. We very much appreciate your time and effort.

11:43

Meeting continued in private until 12:06.

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