



**Cynulliad Cenedlaethol Cymru
The National Assembly for Wales**

**Y Pwyllgor Menter a Busnes
The Enterprise and Business Committee**

**Dydd Iau, 14 Mai 2014
Thursday, 14 May 2014**

**Cynnwys
Contents**

Cyflwyniadau, Ymddiheuriadau a Dirprwyon
Introductions, Apologies and Substitutions

Ymchwiliad Dilynol i Sgiliau Gwyddoniaeth, Technoleg, Peirianeg a Mathemateg (STEM)
(Sesiwn 1)
Follow-up Inquiry into Science, Technology, Engineering and Mathematics (STEM) Skills
(Session 1)

Ymchwiliad Dilynol i Sgiliau Gwyddoniaeth, Technoleg, Peirianeg a Mathemateg (STEM)
(Sesiwn 2)
Follow-up Inquiry into Science, Technology, Engineering and Mathematics (STEM) Skills
(Session 2)

Ymchwiliad Dilynol i Sgiliau Gwyddoniaeth, Technoleg, Peirianeg a Mathemateg (STEM)
(Sesiwn 3)
Follow-up Inquiry into Science, Technology, Engineering and Mathematics (STEM) Skills
(Session 3)

Cofnodir y trafodion hyn yn yr iaith y llefarwyd hwy ynddi yn y pwyllgor. Yn ogystal,
cynhwysir trawsgrifiad o'r cyfieithu ar y pryd.

These proceedings are reported in the language in which they were spoken in the committee.
In addition, a transcription of the simultaneous interpretation is included.

**Aelodau'r pwyllgor yn bresennol
Committee members in attendance**

Mick Antoniw	Llafur Labour
Rhun ap Iorwerth	Plaid Cymru The Party of Wales
Yr Arglwydd/Lord Elis-Thomas	Plaid Cymru The Party of Wales
William Graham	Ceidwadwyr Cymreig (Cadeirydd y Pwyllgor) Welsh Conservatives (Committee Chair)
Julie James	Llafur Labour
Sandy Mewies	Llafur (yn dirprwyo ar ran Keith Davies) Labour (substitute for Keith Davies)
Eluned Parrott	Democratiaid Rhyddfrydol Cymru Welsh Liberal Democrats
Joyce Watson	Llafur Labour

Eraill yn bresennol
Others in attendance

Alice Gray	Llysgennad Gwyddoniaeth, Technoleg, Peirianeg a Mathemateg Science, Technology, Engineering and Mathematics Ambassador
Donna Griffiths	Rheolwr Strategaeth Sgiliau Cymru, Bwrdd Hyfforddi'r Diwydiant Adeiladu Skills Strategy Manager Wales, Construction Industry Training Board
Yr Athro/Professor Niels Jacob	Pennaeth yr Adran Fathemateg, Prifysgol Abertawe, Sefydliad Gwyddorau Cyfrifiadurol a Mathemategol Cymru Head of the Mathematics Department, Swansea University, Wales Institute of Mathematical and Computational Sciences
Joy Kent	Prif Weithredwr, Chwarae Teg Chief Executive, Chwarae Teg
Emma Richards	Rheolydd Datblygu Prosiect—Addysg, Chwarae Teg Project Development Manager—Education, Chwarae Teg
Jane Richmond	Pennaeth Dysgu a Dehongli, Gardd Fotaneg Genedlaethol Cymru Head of Learning and Interpretation, The National Botanic Garden of Wales
Dr Anita Shaw	Dirprwy Brif Swyddog Gweithredol, Techniquet Deputy Chief Executive Officer, Techniquet

Swyddogion Cynulliad Cenedlaethol Cymru yn bresennol
National Assembly for Wales officials in attendance

Olga Lewis	Dirprwy Glerc Deputy Clerk
Siân Hughes	Y Gwasanaeth Ymchwil Research Service
Claire Morris	Clerc Clerk

Dechreuodd y cyfarfod am 09:30.
The meeting began at 09:30.

Cyflwyniadau, Ymddiheuriadau a Dirprwyon Introductions, Apologies and Substitutions

[1] **William Graham:** Good morning, and welcome to this session of the Enterprise and Business Committee. I welcome our witnesses. Thank you for your attendance today. The meeting is bilingual in accordance with National Assembly policy, and headphones can be used for simultaneous translation from Welsh to English on channel 1, or for amplification on channel 0. The meeting is being broadcast and a transcript of the proceedings will be published later. May I remind Members in particular to turn off their mobile phones? There is no need to touch the microphones, as they will come on automatically. In the event of a fire alarm sounding, I ask Members and witnesses please to follow directions from the ushers.

Ymchwiliad Dilynol i Sgiliau Gwyddoniaeth, Technoleg, Peirianeg a Mathemateg (STEM) (Sesiwn 1) Follow-up Inquiry into Science, Technology, Engineering and Mathematics (STEM) Skills (Session 1)

[2] **William Graham:** We welcome today Anita Shaw, Niels Jacob and Jane Richmond. If we may, having had your papers, we will go straight into questions. I ask Rhun for the first question.

[3] **Rhun ap Iorwerth:** Byddaf yn gofyn rhai o fy nghwestiynau yn Gymraeg i ddechrau pethau y bore yma. I ofyn cwpl o gwestiynau cyffredinol ynglŷn â gwaith yr Academi Wyddoniaeth Genedlaethol, sut yn union mae'r canolfannau yn gweithredu a sut mae gwahanol bartneriaid yr academi yn cydweithio â'i gilydd? Rhowch rhyw drosolwg i ni, os gallwch chi.

Rhun ap Iorwerth: I will ask some of my questions in Welsh to kick things off this morning. To ask a few general questions about the work of the National Science Academy, how exactly do the centres operate and how do the academy's various partners collaborate with each other? Give us some kind of overview of that, if you could.

[4] **Dr Shaw:** The National Science Academy was set up, as you know, to raise interest in STEM—science, technology, engineering and mathematics—subjects in children and adults. When it was first set up, the Welsh Government asked three organisations—Techniquet, Techniquet Glyndŵr and the Wales Institute of Mathematical and Computational Sciences—to be hubs. From then on, it has included the Centre for Alternative Technology in Machynlleth and the National Botanic Garden of Wales as hubs. The role of the hubs since the start has been as advisers to the National Science Academy, although I have to say that we have not had a meeting since September 2012, so personally I would not want to talk a lot about what is happening within the National Science Academy at the moment. However, I am aware that there was a funding round of 18 months for grant funding, so I think that 29 organisations are being funded at the moment, and that funding finishes in March 2015.

[5] **Rhun ap Iorwerth:** Pa mor aml ydydych chi'n cyfarfod a dod at eich gilydd fel partneriaid gwahanol yn yr *hubs* fel arfer?

Rhun ap Iorwerth: How often would you meet and come together as partners within the hubs usually?

[6] **Dr Shaw:** When we were meeting within the National Science Academy, we were meeting three times a year. The organisations within the hubs, such as Techniquet and Techniquet Glyndŵr, obviously, meet regularly as partners. However, in terms of the National Science Academy, we have not met since September 2012.

[7] **Rhun ap Iorwerth:** Pa fath o effaith ydych chi wedi ei chael? Pa lwyddiannau allwch chi bwyntio atynt rydych chi wedi eu cael? **Rhun ap Iorwerth:** What kind of impact have you had? What successes can you point to that you have had?

[8] **Dr Shaw:** In terms of the National Science Academy?

[9] **Rhun ap Iorwerth:** Yes.

[10] **Dr Shaw:** May I just quickly say that one of the reasons why there has been a lull in the meetings is that John Harries was ill and then retired, so there was a bit of a lull between the old chief scientific adviser for Wales and the new one, Julie Williams? I just wanted to throw that into the mix, because it is important to note that the reason was valid as to why we were not able to have meetings. Would one of you two like to come in?

[11] **Professor Jacob:** WIMCS, the Wales Institute of Mathematical and Computational Sciences, is a hub member of the National Science Academy. The hub, as we have learned, as part of that, has not met very often recently. There is now a meeting scheduled for 23 May. The main impact that the National Science Academy had on the work of WIMCS was that we were given some funding. For example, there has been some funding available for continuous professional development for teachers and also for roadshows for school pupils at certain levels, from years 7 to 9. So, in some sense, WIMCS in its work for the National Science Academy is more about resources and the possibility to co-ordinate. That is some sense of how WIMCS is benefiting from this.

[12] **Rhun ap Iorwerth:** One would guess perhaps that, if you are not meeting, you are not able to move things forward, even though there are good reasons why you may not have been meeting. It must be a real challenge to get things done.

[13] **Professor Jacob:** I would agree with that, but I must admit here that I am the wrong person to ask. I am the head of a department. WIMCS has a huge outreach programme and the person who runs it, Professor Ken Morgan, has now retired. As you know, nowadays, there are meetings and there is also a lot of informal communication between partners, such as e-mail exchanges. I believe that more was actually done in such exchanges than in meetings, really; otherwise, WIMCS could not benefit from all of these things. Yes, people do not meet, or have not met.

[14] **Rhun ap Iorwerth:** Do you think that the academy has been effective, again considering the fact that the hubs do not actually get together that often?

[15] **Ms Richmond:** I have not actually been. The director of the gardens has been the person who has actually gone to the NSA meetings. She then feeds back to me as head of the learning department. However, I would say that the NSA has had a positive impact as far as the grant funding and things like that are concerned, particularly with engaging with lifelong learners and wider audiences from the schools, universities and industries sectors—those three strands. It has brought a much greater dimension to science knowledge, I think. The potential there is fantastic. My concern would be that it has lost its impetus because of these meetings, and it really now needs to invigorate, because the work that was started was excellent and it now needs to be taken forward.

[16] **Rhun ap Iorwerth:** So, to get the tenses right, it had been doing good work, but it really is not doing much now.

[17] **Ms Richmond:** Yes.

[18] **Dr Shaw:** May I comment further on that? The meeting that Niels mentioned, on 23 May, is to start to look at the strategy. I think that one of the problems that there has been is that there has not been a strategy in place. It was something that was written into the science policy for Wales, that there would be a strategy for the NSA. That is obviously incredibly important because, otherwise, we are not sure exactly of the direction. We know what the main aim of it is, and there is no problem with that. I think that we are all in agreement with that. However, actually having a strategy to work to is really important. So, on 23 May, given that there has been this long break because of a change of chief scientific adviser, plus the fact that John was ill before that—. I think that this is certainly a great time to restart that. The really important things, as part of that strategy, are that we do not have an idea in Wales about exactly what is going on with science enrichment. So, a few years ago, an organisation called Dateb was commissioned by the NSA to do some monitoring of the STEM enrichment activity that was going on in Wales. To my knowledge, that report has not been completed. Techniquet and other members—and I talk on everyone's behalf here—certainly in the meetings that we went to, felt that there was more work to be done on what had already been started.

[19] The important thing is that, if you do not know what is going on in terms of STEM enrichment, it is difficult to know what is needed. So, it is really important to monitor the sort of work that is already happening so that we know what needs to continue and where the gaps are—where the gaps are in subject knowledge around Wales, and where the gaps are geographically. Just to give you a quick example, Techniquet's mission is to reach every single student in Wales once per year, and key stage 2 students, the seven to 11-year-olds, three times per year. That would be 750,000 interactions per year. How do you know that you have seen all of them once if you cannot monitor? So, Techniquet is looking at the moment at how it can work with partners to achieve that. Really, the NSA needs to be leading something like that, so that we can say that, in Anglesey, for example, there has been really fantastic work done. They have Wylfa up there, and other organisations that are likely to focus on a particular part of STEM. Maybe in other parts of Wales that sort of thing is not happening. Therefore, we need to share experiences. So, monitoring is really important.

[20] There is one last thing. Sorry, I know that I have been talking for a while, but I will have to have some water in a minute, so that will stop me. Evaluation is the other thing. So, there is lots of activity going on, but we need to have a standard evaluation that makes sure that every single bit of enrichment, which is all being paid for—a lot of it is being paid for by us and by people in Wales—is of the right quality. Techniquet uses, as do many organisations, something called the generic learning outcomes, which look at affective rather than cognitive learning, but at the moment there is a big fund available through the Wellcome Trust and the big funding arm in America—the national science foundation. The fund is called Science Learning+. We feel that the NSA should support a Welsh bid to that fund. There is a big meeting that Techniquet will be going to in the next few weeks to discuss that. So, I think that there is plenty of opportunity for the NSA, certainly now that Julie is in post and we have this meeting to start looking at strategy. That is really important. So, monitoring and evaluation are the two big things. Finally, it is really important that the department for education and skills works with the NSA because, obviously, the NSA sits within the economy, science and transport portfolio. So, that is the key thing to say.

[21] **Professor Jacob:** One thing I would like to see in Wales is more co-ordination. We have a lot of activities now to do with STEM subjects and education. One of the flagship projects where you have collaboration between universities and schools is the further maths support programme Wales, which is very well funded by the Welsh Government. However, in some sense at the moment, it is detached from other activities, and I believe that it would be very helpful if there were not so many different things and we concentrated on co-ordinating things. Maybe under the umbrella of the NSA or whatever, but not so many diverse things. We need a few partners to speak with a few people to co-ordinate things and I think that it

would be much, much better. In this sense, it could be the new programme or the new task for the NSA to co-ordinate these things, to streamline things to be more efficient and not to have something in every place.

[22] **William Graham:** Sandy, you had a supplementary question.

[23] **Sandy Mewies:** Yes, may I just ask about that? I am not clear exactly what you were saying. There has not been meeting since 2012; we are now in 2014. You are having a meeting on 20 May—

[24] **Dr Shaw:** On 23 May.

[25] **Sandy Mewies:** I do not know—I mean, I am surprised—. I understand what you were saying about someone being ill, but that does not usually stop a body from meeting for that length of time, unless—. I wonder whether it means that the work that the NSA was doing—. You were saying that it was not very visible. How valuable was that work? What would you like to see happening when it starts meeting in May? What sort of things should it be doing so that that long gap would be noticed?

[26] **Professor Jacob:** I cannot say too much because I am not directly involved in this. However, pretty immediately, I can say that, if there is a gap of two years between meetings, there is a problem. On activities, for example, the NSA funded Maths Apps careers roadshows to 24 secondary schools in 2013, reaching 7,000 students. There was a similar thing for 32 secondary schools in 2014. So, there have been activities funded by the NSA. So, certainly, its ability in activities is there due to the funding spread to certain partners. However, there have been no meetings and, I guess, no programme board.

[27] **Sandy Mewies:** Who is evaluating what was happening with those activities, then?

[28] **Professor Jacob:** I cannot tell you. I am sorry.

[29] **Dr Shaw:** Techniquet was not funded in the round that is happening at the moment, which finishes in March 2015. However, we were funded the time before for some activity and every single person who has funding has to report back to the Welsh Government based on a set of objectives that were agreed with the Welsh Government when the funding was first given. I have said what I think we should be looking at, which is the strategy, monitoring and evaluation and linking more closely with education. However, I think that the reason that there have not been any meetings is because the Welsh Government has not called the meetings. So, it is difficult for us—

[30] **Sandy Mewies:** That is a definite reason, is it not?

[31] **Dr Shaw:** We sit on a committee that is chaired—was chaired—by the Chief Scientific Adviser for Wales, so we do not choose when the meetings are. There was meant to be one in February, which was postponed, and there was meant to be another one in July, which no members could make—this was in 2013 from looking back at the notes from that time. It is difficult for us to comment on a committee that is run by the Welsh Government, but, absolutely, it is very unfortunate that there have not been more meetings in the past year and a half, since the last one in September 2012. Hopefully, this meeting in the next week will start to redress the balance so that it can really start motoring forward and making a difference.

[32] **Sandy Mewies:** So, what you want to see it do is formulate a strategy and work towards that strategy—

[33] **Dr Shaw:** Absolutely—

[34] **Sandy Mewies:** —which it obviously has not been doing.

[35] **William Graham:** Thank you. Eluned is next.

[36] **Eluned Parrott:** May I just clarify something? The National Science Academy, as far as you are aware, has no strategy.

[37] **Dr Shaw:** Sorry, I am very aware that I am doing the talking. Would you like to comment?

[38] **Ms Richmond:** No, go on.

[39] **Dr Shaw:** I would say that the strategy of the National Science Academy, as laid down in the science policy for Wales, is there. However, for STEM enrichment and how to move forward in terms of the additional activity on top of what is done by schools in the curriculum, that has not been laid down. So, that is something that I think—*[Interruption.]* Sorry, Eluned.

09:45

[40] **Eluned Parrott:** Sorry, I just wanted to ask: were the hubs given specific strategic objectives that they were supposed to be achieving?

[41] **Dr Shaw:** No.

[42] **Eluned Parrott:** Were you funded to deliver particular parcels of work?

[43] **Dr Shaw:** The only time the hubs have been funded by the National Science Academy is when they have bid for funding and have had some funding back for a grant. Techniquet also had some funding to do some work on STEM ambassadors right at the beginning, and it also had some funding with partners to be at the National Eisteddfod—so, that was not through the grant round. There was talk right at the beginning of the hub partners being funded for the advice that they were given, but that has not come to fruition.

[44] **Eluned Parrott:** So, you have no hub funding; the only funding the hubs have had is when they have applied successfully through a grant round for activity purposes. Is that correct?

[45] **Dr Shaw:** Or otherwise, as I said about the Eisteddfod, but yes.

[46] **Professor Jacob:** It is a very precise platform. From our point of view, the NSA serves mainly as a further resource for getting funding for outreach activities, mainly in the case of WIMCS for schools.

[47] **Eluned Parrott:** So, against that, if you have no objectives and the strategy that the NSA is delivering has not been pinned down as far as science enrichment goes, how on earth is anyone supposed to understand whether or not the work of the NSA in this area has had an impact? If there are no objectives, how can we decide whether or not somebody has been successful in delivering something? Have you not been given an impossible task, to be a hub but not to be told what a hub is?

[48] **Dr Shaw:** Just for clarity, the group meeting as part of the NSA has terms of reference. So, there are certainly terms of reference for those meetings. So, just to be clear, we

are aware of why we are at those meetings, which is to give advice to the NSA on STEM enrichment activity. Beyond that, however, the first part was the Dateb report, and I remember seeing a draft of the final report, and I commented on it in April 2012. So, obviously, that was the first step, to get an idea of what was going on, and not long after that, John Harries went off sick and later retired from the post. So, certainly, the work had commenced to start the strategy, but it had not been completed in the task. Certainly, as I said, I have not seen that published anywhere.

[49] **Eluned Parrott:** However, you have been called hubs—

[50] **Dr Shaw:** Yes.

[51] **Eluned Parrott:** —and appointed to do a job two years before anyone had decided what that job was.

[52] **Dr Shaw:** Before the strategy for the whole of Wales had been decided, the terms of reference for the committee had been decided; so, yes.

[53] Is the NSA coming to this committee to be able to explain, because I think it is quite hard for us, as people who sit on a committee? I am happy to answer questions, as far as I know the answers, but, certainly, my colleagues here have not been to committee meetings, and so I am really—

[54] **William Graham:** We understand that.

[55] **Eluned Parrott:** We are very grateful, as I say—

[56] **Dr Shaw:** No, no. I am really happy to answer; there is no problem with that.

[57] **Eluned Parrott:** I am just trying to understand what has happened in this particular area of work, because it seems that you have been given a task that was never really outlined to you. So, if I were to ask you to demonstrate to me what the impact of the work of the hubs has been, you are not going to be able to do that, because you have never been given an objective, it seems. What would you say you have done as hubs? What has been your priority in terms of the work that you have done?

[58] **Ms Richmond:** Right. Well, I am head of learning, and so, basically, I am at the coal face, as it were, of delivery at the botanic garden. I would say that with becoming a STEM hub, as far as the teachers who come to us are concerned, they are sort of unsure as to what a STEM hub actually might be—that is, the teachers who came from the schools—

[59] **Eluned Parrott:** That does not surprise me.

[60] **Ms Richmond:** They think that it is important, because it is a nice title and everything. As far as my delivery is concerned, and in terms of what we do, we promote STEM subjects anyway. It has not necessarily had the greatest impact at the coal face on what we are doing, as such, as we are doing that anyway.

[61] **Eluned Parrott:** Right. What about in terms of WIMCS?

[62] **Professor Jacob:** In terms of WIMCS, part of the remit was outreach for schools and when the NSA came up, there was a possibility to get resources, maybe to co-ordinate with other partners in similar subject areas. However, essentially, in terms of what I know, it serves as a resource to do some of these outreach activities. I am not aware of a coherent policy.

[63] **Eluned Parrott:** Finally from me, there are a lot of professional companies, charities and organisations like universities that do a huge amount of enrichment and outreach activity across Wales, across the STEM subjects. Was it the intention that the hubs would be a co-ordinating body for all of those activities and, if so, do you work with them on a regular and co-ordinated basis?

[64] **Dr Shaw:** The role of the hub, as we have heard, has not been particularly well clarified, but in sitting on those committees, it was more about advising. My understanding was that the idea was moving towards a strategy of which the first bit was to find out what was going on. Talking about Techniquet, yes, we work across the whole of Wales, as you know; we work with partners all over Wales to deliver our outreach. It is obviously impossible to work Wales-wide without working locally. So, we are in contact with and are engaged regularly with people who work in the same field and always have done. So, the NSA has not made any difference to that, it would be fair to say, because we still work as closely with the people with whom we have always worked closely. We have not worked with the WIMCS before, to be fair, but we have previously worked with the National Botanic Garden of Wales and with Techniquet Glyndŵr and CAT. So, to talk on behalf of Techniquet, there has not been a great difference in the way that we engage, but we already engage across the piece, across the whole of STEM and across all of the ages, so it was unlikely to have an effect—actually, that is not true, but it has not had an effect on how Techniquet works.

[65] **Joyce Watson:** Professor Jacob, you touched very briefly on the further maths support programme to deliver long-term improvements. I want to ask for the views of all of you on the sustainability of initiatives that are brought forward.

[66] **Professor Jacob:** That is a very difficult one. A lot of good ideas often come up and there is some pump-priming. So, good things start, and there then comes the question: a lot of people want to continue with this, but where does the funding come from? Without being more precise on mathematics, the project is starting to make an impact and the Welsh Government is very supportive, but we have the problem that the schools cannot, to be blunt, afford the full further maths support programme as they can in England. Therefore, without further funding from the Welsh Government or without the department responsible for schools giving money to schools, it will not continue. We are in the early phase—the pilot area is in south-west Wales and it is now moving to the north and to a part of the Cardiff area. We do not even cover all of Wales and we often have the problems that schools have to make the decision of whether they can afford to tutor students or whether they need to keep the money for something else. So, the programme is working very well, but it depends on funding coming from the Government because the schools alone cannot afford it, unfortunately. The question is whether the schools are using their resources in the right way. I cannot make a judgment on that.

[67] **Dr Shaw:** For me, sustainability is all about embedding something—I suppose that that is the definition—so that it continues. I think that one of the biggest problems with sustainability at the moment for long-term STEM skills is the fact that there is really limited continuing professional development in schools. I mentioned this in my submission. Up until recently, the General Teaching Council for Wales was a place to which teachers could go to get funding for support, so that if they go for CPD, they get that cover back. It is nearly impossible to do CPD without getting that cover back in schools now. Also, the local education authorities had science advisers—not every single one of the 22 local authorities had them, but many of them did. There are no science advisers any more. There are—. I have completely forgotten their new title, but, anyway, now they are looking at school improvement as opposed to CPD specifically. School improvement is focused at the moment—as it should be, because that is what the strategy is—on literacy and numeracy and tackling the attainment gap that exists because of poverty. There is nothing specific about

science CPD anywhere. If you go to your school improvement person in your LEA and say, 'We really need some support', the most likely thing that you will ask for help with, because it is part of what you need to be doing as a headteacher for your school, is literacy and numeracy and the attainment gap. STEM is not there, and I think that that is a really big problem.

[68] I do not know whether you have the IOP coming here, but, if you talk to the Institute of Physics, it has seen—. David Cunnah, who works as the representative in Wales, did a blog for the Institute of Welsh Affairs showing that there has been a really marked drop in the number of teachers in their 30s and 40s who teach physics—not only that, but the people who teach physics in schools are not necessarily physics teachers. You know what it is like: if you are a student and you are learning from someone, if that person is really keen about the subject, as you would be if you were a physics teacher and a physics graduate, then you are much more likely to be excited about the subject yourself. So, there is a real danger that people who are learning at the moment are not being taught by people who have that keenness and excitement in the subject, but also they do not have the opportunity, those who do not have that, to be able to do CPD, because some of the things that were there previously are not there anymore.

[69] So, for me, when we are talking about STEM skills and making sure that we have enough for the talent pool, as it says in the science policy for Wales, the question is: how on earth can we do that if we are not equipping our teachers so that they can get up to speed, where they are not already up to speed, with the subject? If they are a physics graduate, trying to keep them up to speed with what is happening now is also important. This came up in the Estyn report. I am not sure that it has been answered by the Welsh Government how STEM CPD will be supported. It was showing that there is a real problem in Wales compared with England. I would like to read it out, but I am very aware that I have spoken more than anybody else, so I will now shut up. However, the number of people doing—. Sorry, I am not going to say it, because I will get it wrong, but, anyway, compared with England, we are doing really poorly in terms of GCSEs in science. Estyn flagged up that there was not particularly great quality teaching in primary school, and so what are we doing about it? STEM CPD has to be the answer, and that has to be embedded. Then, we would have a more sustainable way of looking at the longer term science pool that we know is so important for the wider economy of Wales.

[70] **Professor Jacob:** To be very precise, to sum up your questions, what further maths is doing is giving additional tuition to students who are taking further maths at school because many schools do not have enough teachers who can do that. Not only do the teachers not have the time, often they do not have the qualifications. Therefore, continuous professional development of teachers will be very important here. We see the schools, and more importantly the teachers, being very reluctant to engage in this continuous professional development. There is not really a programme set up, but there are some ideas, and this is somewhat in contrast to England.

[71] **Ms Richmond:** May I also just add that I was a biology teacher in secondary school before I took up my current position? To reiterate what has been said, I, as a biology teacher, was expected to teach physics at key stage 3, which was fine, but I would say that I did not have the expertise to be able to deliver confidently at key stage 4. I found myself in that position a few times, and I was not the only teacher, and it was not just that combination. That is a real problem in schools. I would also say that some of the mathematics departments in some of the schools that I have taught in had business studies graduates, not pure maths graduates. Again, I think that that had an impact on things. As far as CPD is concerned, I deliver CPD at the botanic garden and the funding opportunities for schools to get out are a real problem. There used to be support through Careers Wales and through the education and business partnership for funding for teachers so that the cover could be paid in the school for

the teacher to come out. That has all disappeared over the last couple of years, so we have seen quite a significant drop in the number of teachers being able to come out of school. Also, last year, in the botanic garden, we trained 312 people as part of initial teacher training. They were people who wanted to go into the teaching profession in some way, so they were maybe doing an early years course. Some of those were also on the graduate scheme. I would say that, out of those, about 280, roughly, wanted to go into the primary profession. Out of those, three were science graduates.

10:00

[72] **Mick Antoniw:** This leads into a couple of questions that I wanted to ask, which really are about the teaching of STEM in schools and colleges. Perhaps I could explore that in a little bit more depth. When do you think we should be starting? At what sort of age should we be starting to do this?

[73] **Ms Richmond:** I am probably going to be slightly controversial here. When I was in school, we did not have science, per se, in primary school, but we had things like nature studies and all sorts of other things, and it fostered curiosity among children. I would say, having had a son who has gone through primary and secondary education, and him having had science taught as science in primary school by teachers who, I would say, did not have a science background, that, actually, that is quite off-putting, because you are not being taught well. It is just human nature: if you do not have that knowledge, enthusiasm and confidence yourself, how can you put that subject over well to primary-age pupils? Primary-age pupils, by their nature, are curious. I think that having a curriculum that would foster that curiosity, rather than saying, 'This is science' as such, would serve Wales an awful lot better than is the case now. I would say that, when I went to secondary school myself, science was this amazing thing that I was so looking forward to being taught by experts. That was fantastic, and I do not think that children have that now. I think a lot of them are put off. I see them come to us at the botanic garden, and I see teachers there who do not know how to teach some of the basics of plant biology. They can say, 'a leaf is the food factory of the world', and that is about all they can manage; that is all the confidence they have. Unless we do all that CPD to bring people up, or unless we look as a whole at the way that we approach science at primary school—. I think that is the way that we should be going.

[74] **Professor Jacob:** There are a few things here. When we look in universities, in the first year, and also a bit later, at the skills of our students, we find, very often, that the very basics are not there. We have gifted students; there is no doubt about. We find, after a few weeks, when they have just started at university, that they can, say, in mathematics—although it could also be physics or computer science—do reasonably well in what we taught them anew, but we cannot rely on them having brought a lot from school. Manipulation of fractions is not science, but it is a skill that everyone should have. Writing two sentences in more or less correct English, so that a reader can find out what you mean, is a skill that should come from school; this is not science. We are missing this. To be very clear, schools are not delivering on these elementary things. Elementary geometry is something that we need everywhere in science. Those skills are not there. So, we should not speak about science too early on in schools; before the ninth or tenth forms, we do not need science. We need all these general skills—numeracy and literacy. People should be able to write and they should be able to give a short talk for five minutes about a very simple topic and speak freely. These things are missing. For gifted students, once they have the basics, you can always teach the subjects you like, and then they can speed up very fast. However, what we are missing here, across the board—. I am a mathematician. I do a lot of mathematics and work with scientists, but skills in English and presentational skills are at least as important as numeracy skills in mathematics, and we are missing them. So, that is something that we have to do in order to do things better in terms of science education. Science includes demanding things that are so complex and complicated that they should start later at school, in the ninth or tenth form.

However, we should build this up and raise interest.

[75] **William Graham:** Just before you start, I am very conscious of time. We have another 10 minutes to go. Could we have concise questions and answers, then we will get through our papers?

[76] **Dr Shaw:** May I add something very quickly, because I disagree with both of them. I think that it should absolutely start at the foundation phase. It should start from day one. There is absolutely no reason why science should not be a part of everyday life. The biggest problem, I think, with science is that people think that it is too difficult, it is for the brainiest children and it is 'other'. It is not. It should be part of our culture and, until we start treating it like that, it will remain something that people do not want to do.

[77] I will be ever so quick, Chair. There was a fantastic study that you must read. It is from King's College London and it is called the ASPIRES project. They talked to 10 to 14-year-old children and worked with them for five years to find out what their aspirations were. It is really simple. This is one of the key findings: the large majority at that age were really excited about science, but when they were asked, 'What do you want to do when you grow older?', they said, 'We love doing experiments and we love doing—' I will be very quick, Chair. They said, 'I would really like to be a doctor or a lawyer'. Not one of them said, 'science', and yet they were desperate about science. How on earth does that happen? It happens because—this is their finding, not mine—they do not have role models, so, if they had a parent, or someone down the road, or an uncle or aunty who was doing science, technology, engineering and maths, they were more likely to aspire to work in STEM later on. If they did not have that, then they were less likely to, even though the whole group, largely, was really interested in science. So, for me, it starts early on. The problem is not about—Yes, literacy and numeracy are incredibly important, but is it not about stopping doing science because we do not have the teacher skills; it is about making sure that we do have the teachers in schools to be able to do science. It is really important. How can we leave it any later than it has been left already? It has to be done and I think that the creativity in the foundation phase of the curriculum is really fantastic, and maybe it is just that teachers feel uncomfortable teaching it, because it requires a lot of allowing the children to learn on their own. So, personally, that is my feeling.

[78] **Ms Richmond:** I was not saying that we should not do science; I was saying that the way that we actually present is the problem.

[79] **Mick Antoniw:** May I just come in there? I know that we are short of time, so I will be very quick. I attended a lecture by Sir Chris Evans the other night, which was inspirational. Exactly the same question arose: that we have a serious gap at the early teaching level, which continues through, in inspiring and aspiring and the link with entrepreneurialism and everything else. Is that a serious gap that has to be addressed?

[80] **Dr Shaw:** It is about role models; it is about CPD for teachers and it is about getting teachers confident enough. We have done CPD at Techniquet. We used to develop it ourselves and run it, now we run it for the National Science Learning Centre in York. When we do CPD with primary teachers, they love it and they say, 'This is actually quite easy to teach; it is not difficult'. I do not think that anyone in this room would find it difficult to teach foundation phase and key stage 2 science if they had the right training. As soon as you have the right training, you are confident about it and then you can become passionate about it as well. That is what we have seen when we have done CPD. I am sure that it is exactly the same at the botanic garden as it is in the Wales Institute of Mathematical and Computational Sciences, although, obviously, the teachers are teaching older groups there.

[81] **Mick Antoniw:** But there is a significant skills gap in that area.

[82] **Dr Shaw:** Absolutely, and Estyn has recognised it and it is absolutely maintained all the way through.

[83] **William Graham:** Julie is next.

[84] **Julie James:** Thank you, Chair. Well, on that happy note, I turn to the situation of girls, which, as I think we all know, is even worse than that of the general population. I hear what you say loud and clear, but what do you think that we could do in addition to that to sort out the problem of girls falling out of STEM subjects, pretty much at every stage all the way through?

[85] **Ms Richmond:** It is, I think, fundamentally down to the role models and I would say that in schools, particularly in secondary schools, you have mainly men teaching physics and chemistry, particularly. You may have women teaching biology, but that is not always the case. Also, the heads of departments are usually men, so I think that this fundamental role model thing is a real problem. I also think that there should be more opportunities within the curriculum to actually shout about the achievements of some women scientists. We had a project recently at the botanic garden looking at female botanists in Wales and we had a terrible problem finding out about their achievements. They were fantastic and they were world class, but could you find out the information? I think, as part of the Cwricwlwm Cymreig, we should be shouting about the talent that we have here, particularly some of the women.

[86] **Dr Shaw:** I agree with everything that Jane has just said. It is a little bit about normalising as well, and what I said about science. It is about people accepting that women are scientists, and, therefore, I myself could also be a scientist, because it is something that I would be interested in. We recently did a study with funding from the Welsh Government. We did some questions with key stage 3 pupils, key stage 4 pupils and post-16 pupils about why they thought that young girls did not do A-level physics, and it was all about the stereotypical views of physics, and how they saw themselves. It is really distressing that, in this age, that is still the point of view. So, it is about role models, absolutely.

[87] I have to throw in that, having read the science policy for Wales and looked at all the pictures in it, I think that the Welsh Government needs to be absolutely clear about the fact that we all have to do it—it has to do it as well—and that the whole of Wales has to work towards this. There were eight pictures of named scientists—and I can see that Joyce has counted them herself—in the science policy for Wales, and just one of those named scientists was a woman. That is shocking; this was before Julie Williams was the chief scientific officer. You have people such as Karen Holford at Cardiff University, who is one of the pro-vice chancellors—one of the top people at Cardiff University—and she was not chosen. Anyway, that is an important point.

[88] I was really pleased to see last week that the Welsh Government brought out this new policy—not a policy, but an initiative; and you know what I am going to say, do you not?—called ‘Education begins at home’. That, for me, is absolutely key. How can you have people aspiring to do science—girls aspiring to do science—if, at home, it is not seen to be something that is doable or achievable? That has to be about the parents at the beginning, and that was also something that the ASPIRES project that I mentioned earlier found. So, we have to include parents in this whole thing; it is not just about teachers, as it has to be parents as well.

[89] **Julie James:** May I ask you one last thing? We have had a lot of evidence around the place from the Institute of Physics, and various other things, but one of the things that I am interested in is that there has recently been a study in America where a whole series of

undergraduates wrote asking for doctoral supervision from various institutes across America, including the Institute of Directors' school of management, which was actually conducting the research. Almost universally, white-male-named students got a better response than anybody else. That was even from black female professors, and so on. The only exception to that was Chinese-named students applying to Chinese-named professors, who were treated equally with white males, not better. I have to say that I found that myself, in my own research here. What can we do about that? That means that women are discriminating against women as well. What can we do about that unconscious bias?

[90] I know it is a complex question, but how do you make a department like the engineering department at Swansea—I do not know about maths, I am sorry—more attractive to female students when there are going to be three of them in a population of 450, or whatever it is?

[91] **Dr Shaw:** I do not know the study that you are talking about and I think that maybe—

[92] **Julie James:** I will send it to you.

[93] **Dr Shaw:** Thank you; I would appreciate that. I think it is about what I said earlier about normalising it so that it is not seen as different. I went to Imperial College, so I know exactly what it is like to be one of seven, when you are talking about the ratio of women to men. Thankfully, I did biochemistry, so it was 1:1. I do not know; that is a really difficult question. It is a long-term thing. It is a wider issue than just what can be done in—

[94] **Julie James:** It has not changed in 25 years.

[95] **Dr Shaw:** I know, yes.

[96] **Professor Jacob:** I must say that university departments, of course, want to respond to such types of gender policy, or equality policy, but the decisions are essentially made when the students decide which subject they are going to study. So, in these critical last two years at school, there should be changes that can trigger something. I do not believe that the universities are in a position—unless we start positive discrimination, giving scholarships to females only, or things like this. This is a bigger political issue that, for us, must be decided by politicians, who say, 'We shall do this', and then we can implement that. I am not sure whether it is a good solution. So, the decision comes when the young people make their decision, 'What do I study?', when they are still at school. That is the time when we have to find a solution for their career paths, not when they are at university.

10:15

[97] If you try to convince the few females in the engineering department to study further, for a PhD, you will not solve the problem, but if you get, let us say, 30% of the engineering students being female, then you have solved the problem to a certain extent. So, there is the real borderline where we have to do something—from school to university.

[98] **Joyce Watson:** May I just ask you something?

[99] **William Graham:** Very quickly.

[100] **Joyce Watson:** I am sure that the university has to accept some responsibility in terms of funding PhD students et cetera. I accept what you have just said, but there is the next stage, beyond university. So, you have x number of students, and then you decide to fund some to go on to do higher level studies. Do you accept, then, that the university has to be

mindful in that capacity of looking equally at male and female students?

[101] **Professor Jacob:** Yes; I accept it immediately. Usually, in the STEM subjects, the mathematicians are better than say physics or engineering. I think that the biologists sometimes have more females than males. In the physical sciences it is usually the opposite, but in mathematics, it is a bit better than the others, but that is still by no means parity. Yes, there is a responsibility, but, of course, much depends on the pressure that you are under. You have to go for very good students. You are competing, and you have to see what you can do. There is a type of responsibility. In the department where I am, I have responsibility, and I try to do it, but things are difficult. You have first to have the candidates, and then you have to have the resources, and you do not have a lot of resources for PhD students in Wales.

[102] **William Graham:** Finally, a short question from Rhun.

[103] **Rhun ap Iorwerth:** I would like just a quick overview from each of you, very briefly, on developments have taken place in the teaching of STEM subjects through the medium of Welsh over the past few years. How do you think it is going?

[104] **Ms Richmond:** I would just say that, in our experience at the botanic garden, we have a real problem with recruiting Welsh teachers who have a science background. So, we struggle to continue to make strides in that way. Out of all the teachers who have come to me in the past couple of years, any Welsh-speaking teachers were from—I had a religious studies teacher and a home economics teacher who wanted to come and teach at the botanic garden.

[105] **Rhun ap Iorwerth:** No stereotypes here, no.

[106] **Ms Richmond:** Sorry. What I am saying is that I actually had no scientists who wanted to come. I will also say, however, that as far as English-medium teachers are concerned, I have had none from secondary education who have been interested in coming to teach at the botanic garden either.

[107] **Dr Shaw:** I did not answer anything about this—I apologise—in my evidence. I do not know enough about it. I can tell you what happens at Techniquet, but I do not know enough about the more global, Wales-wide picture I am afraid. I am sorry; that is as much as I can say on it.

[108] **Professor Jacob:** In Wales, in the northern part—Aberystwyth and Bangor—there is of course some traditional teaching of some STEM subjects in the medium of Welsh. In the southern half, in Cardiff and in Swansea, we are just starting. We began the activities that we now have about five years ago, when we appointed a Welsh-language fellow in order to promote it. He is now a lecturer and doing very well, and I see that, in physics and computer science, Swansea has now appointed a similar person. Cardiff has appointed a lecturer in mathematics for its Welsh-medium studies. What we find is that it is even worse than you think, as there is no teaching material. There are not even any teaching materials in the medium of Welsh for, let us say, final year calculus at school matching first year, or first term, calculus at university. That is why I sat down and worked with Kristian Evans to get my first-term lecture notes translated and amended in the Welsh language. We have nothing in geometry on the syllabus and not much about algebra, but if you look to physics and computer science, there is plenty more to do. If you want to improve this, you need people at the universities, and there are not so many with the correct skills, because they are measured against other research applicants. However, we also need some sort of priority for the STEM subjects—they collect, at the moment, the numbers of students, and they do not give a lot of funding for the development of new things in STEM subjects. So, there should be more money from the moneys they have oriented to us in the STEM subjects, so that we can build up—and we are, at the moment, creating capacity, not already serving demand.

[109] **Rhun ap Iorwerth:** Thank you very much. Diolch yn fawr iawn.

[110] **William Graham:** Thank you very much. I neglected to ask you to give your names and titles for the record, so could we end on that? We are most grateful for your evidence. Thank you very much for your attendance today and for the way in which you answered our questions. May I ask Jane to start?

[111] **Ms Richmond:** I am Jane Richmond, and I am head of learning and interpretation at the botanic garden.

[112] **Dr Shaw:** I am Anita Shaw. I am the deputy chief executive officer at Techniquet, and thank you for the invitation to talk today.

[113] **Professor Jacob:** I am Niels Jacob. I am the head of mathematics at Swansea University.

[114] **William Graham:** Thank you very much for your evidence today. I ask Members to be back so that we can start promptly at 10.30 a.m.

*Gohiriwyd y cyfarfod rhwng 10:20 a 10:32.
The meeting adjourned between 10:20 and 10:32.*

**Ymchwiliad Dilynol i Sgiliau Gwyddoniaeth, Technoleg, Peirianeg a
Mathemateg (STEM) (Sesiwn 2)
Follow-up Inquiry into Science, Technology, Engineering and Mathematics
(STEM) Skills (Session 2)**

[115] **William Graham:** I welcome our witnesses to this part of our inquiry. May I thank you for your written papers? Could I ask you to give your names and titles for the Record?

[116] **Ms Kent:** Yes, Joy Kent, chief exec, Chwarae Teg.

[117] **Ms Gray:** Alice Gray, STEM ambassador.

[118] **Ms Richards:** Emma Richards, project development manager—education.

[119] **William Graham:** Thank you very much. We will go straight into questions, if I might ask the first one. What are your views on the National Science Academy's role in addressing gender perceptions, particularly negative ones and stereotypes, and whether they have any impact?

[120] **Ms Kent:** First, thank you for inviting us along. As you have already identified, our best contribution to the committee will be around gender issues. Just to give a little bit of background, Chwarae Teg's vision is to see a Wales where women achieve and prosper, and STEM is one of those areas where we think that we can make huge inroads into improving on women's current contribution. I think that there are lots and lots of things that we can do, and there are lots of bodies and initiatives already doing really good work around this, but the first thing that we would want to say would be that not one organisation or one initiative is going to make the difference. It has got to be a co-ordinated response throughout a woman's life, from childhood right the way through, and also working with employers to make sure that both sides of this are addressed.

[121] Emma, you have done some work around these issues. I do not know whether you

want to respond more specifically to the question.

[122] **Ms Richards:** I think that, potentially, one of the opportunities for the National Science Academy—and we would agree here with the task and finish group from the Science Advisory Council for Wales—is to ensure that effective gender-disaggregated data are collected so that we can get a fuller picture of STEM-enrichment activities and how they can benefit and be taken up by participants. Also, perhaps there needs to be a mechanism built in to ensure that those organisations that are funded by the National Science Academy are paying particular attention to gender equality and the interests of both boys and girls, to make sure that the take-up and the interest is sustained throughout both genders.

[123] **Ms Kent:** Alice worked with us on our response, so I do not know whether there is anything, Alice, that you would like to add to that. If Emma has covered it, that is fine.

[124] **Ms Gray:** Yes, I think that she has covered everything.

[125] **Ms Kent:** The single point that I would bring out of that is that, again, across the board, having gender-disaggregated information is the key to our being able to answer questions about how effective different initiatives are. That is not there in a lot of areas.

[126] **William Graham:** Okay, thank you. The Institute of Physics has suggested that the NSA has funded activities that have been one-off interventions and that it would be naive to think that they will make any difference to gendered uptake. Do you have any views on that? Are they valid at all?

[127] **Ms Kent:** Again, it is difficult to say without robust evidence to back up your perception. There are interventions that are having an impact, but the size of their impact and how they compare to each other are really difficult to quantify without robust evidence.

[128] **William Graham:** Thank you. Eluned is next.

[129] **Eluned Parrott:** Clearly, it is nearly impossible to demonstrate an improvement from point A to point B if you do not have a baseline at point A and then some kind of measurement strategy to take you along. However, in terms of the way that you are approaching your work, I am wondering whether you have seen, or do you believe that there has been, any kind of improvement in addressing gender stereotypes since the science for Wales strategy was published? Can you see progress? Can you see evidence of people working in different ways or tackling the problem in a more strategic way, or do you think that it is not possible to say?

[130] **Ms Kent:** I think that, from the work that we do, because we have that in-depth knowledge of actually delivering something, we can talk more accurately about the impact. I think that we can say that, generally speaking, there is movement across all the areas that Chwarae Teg is interested in where women are under-represented in different sectors and different skills. However, that progress is slower than we would like to see and it is different in different areas. So we know that, for example, in construction—I know that it is not within STEM—despite lots and lots of intervention, things are still stubbornly not moving very much in terms of women's engagement in certain roles. Women are still segregated into admin and certain sorts of areas. Emma leads on our work in primary schools and nursery schools. We have done work with teachers and careers advisers to try to encourage them to see the broader range of science jobs that are out there and that those jobs are maybe not what they have in their minds about what a science qualification could lead you on to. So, yes, there is movement. My feeling, in the absence of robust data, is that there is progress but that it is slower than it could be.

[131] Like I said, there are two sides to this, in a sense. It is about getting more girls and women interested and into those roles, but it is also about working with employers to make those workplaces more attractive and welcoming as well. Again, it is a big thing for Chwarae Teg. It is not just about STEM, but it is particularly in areas that are male dominated where the most work needs to be done, and there is still a lot of work to be done there. The fact that we have such a skills shortage and that we are predicting such a skills shortage in areas such as engineering, for example, opens up doors. However, if I am honest, equalities issues generally do not necessarily resonate with a lot of people. Some people are very interested in them and some people are not interested at all. I think that the economic interest there has an impact—the argument that 50% of the potential workforce is, as we know, doing well in education so would we not want to reach that talent pool in the same way as we reach the other 50% of the talent pool? I think that that argument resonates with people. However, translating that into changing workplaces so that they are welcoming to everybody is still a bit of an uphill battle.

[132] **William Graham:** Sandy, did you have a supplementary question on that?

[133] **Sandy Mewies:** It is about the data issues that you raised, actually. You have obviously identified that as a priority, and I think that Eluned made the point that you cannot measure anything if you do not know where A or B is and you do not have a strategy. That is something that we have heard in evidence from people who contribute to the NSA. Their point, at the moment, is that there does not seem to be a strategy that the NSA is working to. So, would you consider it to be a priority of any strategy that comes up when it starts meeting again that data collection should be a really important point in it? Is that something that you would agree on?

[134] **Ms Kent:** Absolutely. I think that gender-segregated data have to be the—

[135] **Sandy Mewies:** Strategically collected as well.

[136] **Ms Kent:** Yes, strategically collected. Absolutely.

[137] **Eluned Parrott:** Going back to the concern raised by the Institute of Physics that a lot of the interventions that are happening are ad hoc and there is not that kind of strategic approach, are you aware that any of those interventions in and of themselves have good evidence or have developed perhaps some best practice, or evidence that there are other approaches that have worked less well? Are we collecting, if you like, individual data on interventions even if not, sadly, the strategic data that we need?

[138] **Ms Kent:** I cannot speak for other organisations, but I know that we have put a lot of effort into evaluating our interventions, because we want to be sure that we are using public money wisely and that we are having an impact with what we are doing. That is why we exist, to have that impact. Again, I would not be able to answer that question from a really informed position, but I would endorse that it needs to be more strategic and more co-ordinated. We have a fledgling network that is meeting this afternoon from all the anchor companies and the sectors identified for growth. In our first meeting, it became apparent that all of them were working with schools in their local areas. They were trying to get more girls interested in these areas, and they were not all aware that other employers in their region were doing the same thing. So, looking at that from the schools' perspective, they have all these employers perhaps knocking on their doors, and I think that that really does need to be more co-ordinated.

[139] **Eluned Parrott:** That is fantastic. I am wondering, in terms of that network, whether you have involved the educators as well because, clearly, then you have universities, people like Techniquet and a whole range of other people trying to get positive role models and

ambassadors—STEM ambassadors, for example—into schools. How co-ordinated are the efforts between organisations such as Chwarae Teg and those kinds of networks?

[140] **Ms Kent:** We have a really good relationship with Technquest, and we have done some work with it, for example, gender lensing the work that it does, to make sure that it is attractive to both boys and girls. We have good relationships with education, but we can build on those. We are planning an event in September with further education and higher education to raise awareness of our role, what we are interested in, and to build that relationship so that it is more positive. We absolutely recognise the need for that. Do you want to add anything, Emma?

[141] **Ms Richards:** We also have very good relationships with a number of the sector skills councils, particularly in those sectors where women are traditionally under-represented, and we are building partnership agreements with e-skills UK, Lantra, Semta, and the Construction Industry Training Board, to name but a few. We also have links with, for example, the Let Toys Be Toys campaign, which wants to build momentum in this area around gender-marked toys, for example, and now gender-marked books. So, we do have a number of links with good projects. In fact, we actually utilise materials from the NUT's Breaking the Mould project. In terms of co-ordination, I would agree with Joy, and a lot of the other people who have given evidence, that there does need to be a co-ordinated approach. Maybe it is the National Science Academy that could take a lead on that, working with organisations like ours and others.

[142] **Eluned Parrott:** Just finally from me in terms of your experience of going in to work with young people, how early do we need to get in to reach people? A lot of the STEM ambassador work, for example, is targeted very much at the GCSE age group. Should we be going in much earlier, or is it perhaps a waste of resource to talk to very young children about what they might want to be when they grow up, some 20 years in the future?

10:45

[143] **Ms Kent:** I think that all of the evidence suggests, and I feel confident on this one, that we have to do it at various points. Some people believe that if you do not capture them really young, then that is it. I do not agree with that, but I think that you have to get in from a really young age. The research that we carried out, which is also backed up by other research, suggests that it is at age three that boys and girls start to define the world in terms of 'that is appropriate for a boy' and 'that is appropriate for a girl'. So, I think that if we do leave it and only intervene at 14, 16 or whenever, then we have missed a trick because it is really in the home, from day one almost, that we are starting to unintentionally steer boys and girls in certain directions and, as I said, they start to pick up on that at three years of age in terms of thinking what is right for them and what is right for their brother or sister. I think that Emma could add something on the work that we do with nurseries and primary schools and Alice could add something about her role as an ambassador.

[144] **Ms Richards:** Obviously, I completely agree with Joy. I manage the Fair Foundations programme that works with schools and supports schools to create gender-aware learning environments. As Joy said, there is a body of research to suggest that children do make up their minds about what jobs are right for boys and what jobs are right for girls from a very early age—as young as three. As a project, we work with primary schools to support teachers to look at gender explicitly within their school. Schools are only one influence on a child, so we also encourage teachers to look at gender from the perspective of the child and to understand that society, friends, the media and their understanding of the world around them have an effect on who they are and on their interests and what they think is right in terms of career choice later on.

[145] I disagree that it would be a waste of resources to talk to children about the world of work. From our own work in schools, children have been very engaged in looking at the world of work. It is interesting in that we do a number of exercises to ask the children in groups what jobs they think a person with certain skills and abilities can do. What they do not know, in these two groups, is that they have two different case studies where one is female and one is male, and they choose very different routes and pathways for those children. So, we need to talk to children about the world of work. They do have aspirations. Also, we need to continue that work on a family-learning basis, so that that information and that understanding of how gender can affect choices later on in life is also shared with parents and those people who care for those children. A co-ordinated family approach is one that we find works really well, but it is a long-term approach; there is not a one-size-fits-all solution to this.

[146] **Ms Kent:** I was with Hugh Baird College in Liverpool on Monday and, interestingly, it has just started to provide courses from the age of 14 and the person leading their engineering and construction department is a woman. They are finding that, between 14 and 16, the take-up by girls of science-based subjects drops significantly. So, it is important that we get in really early on to keep girls' eyes open to the broader range of options in front of them and then reinforce that all the way through. The ages of 14 and 16 seem to be critical points.

[147] **Ms Gray:** I think that, from a STEM ambassador's point of view, we definitely need to start engaging children from a younger age. There is evidence that it needs to be done from the foundation phase onwards, especially by incorporating female role models from STEM industries, so that children become more aware of the variety of STEM employment and careers as well as the different career paths where they can use STEM skills that are outside the typical ones associated with STEM, such as being an engineer or doctor. The fact that they can use these skills in different areas and how important they are for everyday life, from a young age, needs to be targeted from the foundation phase onward.

[148] **Rhun ap Iorwerth:** Picking up on that, where there has been success in attracting girls into STEM subjects, the kind of disaggregated statistics that we have show that it is more likely to be biological sciences that draw them in. What are your thoughts on why there is much more of an imbalance in, say, physics than in those biological sciences?

[149] **Ms Kent:** I think that this is a really fascinating area, and I think that it goes back to societal influences. We were invited to the cross-party group on STEM, and we brought along two young women who had gone into STEM careers. Both of them, from different schools in different parts of Wales, had had the same experience; they had shown an interest in science subjects and they had both been encouraged to go into medicine or to become vets. They both ended up in engineering-type roles, and when we asked them, 'So, how did you end up where you ended up?', they said, 'I did not get the grades for that, so then they suggested this'. I think that that goes back to our unconscious bias about a girl who is interested in science—she is a girl, therefore, she is caring, so she wants to go into looking after people or animals. I think that that is still underpinning our ideas about what the right roles are for boys and girls and for men and women. That is anecdotal, but we see it again and again in the women that we talk to.

[150] **Ms Gray:** Also, confidence is incredibly important. From a young age, girls begin to doubt their abilities, based around the stereotype that girls cannot do maths and things like that. Ultimately, that affects their ambition and their ideas of what they are capable of. So, physics and chemistry are labelled as hard science, and life sciences, in which women are often in a majority, tend to be considered a soft science. It may be to do with confidence and the fact that women do not believe, from a young age, that they have the capabilities to do these things. Obviously, it is not a simple explanation; it is very much a social stereotype, but

it mainly affects girls, and it needs to be combatted from a young age to make sure that they feel that they can progress to those sorts of areas.

[151] **Rhun ap Iorwerth:** One thing that we discussed in a web chat with a group of students in the past few weeks was the notion that it becomes self-perpetuating, then, in that you do not want to be one of two girls in a class full of boys. It is the strong girls, as Julie would argue, who do not give two hoots about the fact that it is 25 boys and five girls, who will go ahead with it anyway.

[152] **Ms Kent:** Yes, I think that that is absolutely right.

[153] **Ms Gray:** Especially in science, where things get quite competitive, especially for research funding or accolades like Nobel prizes, they have found that women are less likely to put research funding proposals forward, especially if they do not have a mentor, in comparison to men. Women are also less likely to try again later after submitting research proposals. So, this idea that women cannot be competitive may put them off getting into research and things like that, because it is something that they need to do, but they do not think that they would be capable of it. Maybe that is why these ‘strong girls’ pursue these careers, because they consider themselves to be strong and they do not doubt themselves. I think that a lot of girls, from a young age, are taught to doubt themselves, especially to do with their abilities in academic subjects.

[154] **Julie James:** Just for the record, I called them ‘warrior girls’, not ‘strong girls’.

[155] **Ms Gray:** Excellent.

[156] **Mick Antoniwi:** This leads to something that I want to ask about, which is the use of role models. Taking GE Aviation as an example—I was there last week—they always seem to have one female apprentice—these are high-tech jobs et cetera—who always does very well. However, there is almost an incapacity and inability, once they are on that course, to be able to use them as role models—that is, to be able to have a slightly broader role in terms of their job to go out. Do you think that there is a need for better engagement with employers, so that where you have excellent women engineering apprentices coming through, for example, they are able to take on a sort of slightly ambassadorial role, or do you think that employers just are not interested? They want the person to do the job et cetera. Do you think that there is reluctance among employers to see this as part of their function?

[157] **Ms Kent:** Sometimes there is. I have also spoken to ambassadors who have said that they get a little bit weary of being rolled out again and being the only one who is rolled out. The answer to that is that we just need to get more women into those roles, so that we are not reliant on—

[158] **Mick Antoniwi:** Is it not a chicken-and-egg situation?

[159] **Ms Kent:** Yes, it is, but as I said before, there is not one intervention here. We have to work at this from a number of different angles. So, we need more women in those roles and more girls coming through. It is interesting when you look at the percentages in certain careers. Sometimes, you see that percentage represented and you think, ‘Where are the women in this?’ Sometimes, employers have responded to that by thinking, ‘Oh no, we’ve got to put women on our publicity and marketing’ and maybe it is from a cynical perspective and it does not indicate that they have bought into it. However, it is a bit of a chicken-and-egg situation. Sometimes, I think women are kind of over-represented now in the media representation of this, but is that not what we want, because we want women to be attracted into these roles? It is a tricky one, but the key message is that we need to address it from a number of different angles.

[160] **Ms Gray:** As you say, there need to be more women role models from a younger age. When I was at the Women in Science Research Network oral history event in London, they talked about also including women who are not high up in areas of science, so, lower paid—

[161] **Ms Kent:** You mean at a different point in their career.

[162] **Ms Gray:** What they meant were not necessarily the researchers, but the research assistants or technicians. This provides a variety and puts less pressure on the women who are at the top. It is important that a variety is showcased because there are so few women in—what am I trying to say? For women in STEM, at their event—the oral history event—they found that when they were interviewing women in science, a lot of them felt like saying, ‘I’m not important enough to be interviewed, why would you want to speak to me? I’m just an engineer,’ or something like that, whereas males from a young age are more likely to put their skills forward. Again, this stereotype affects the way that women can see themselves as ambassadors and role models. It can affect people. They do not see themselves like that and that can affect how many role models you are producing.

[163] **Ms Kent:** I think that is absolutely right. There is also evidence that role models who are at different points in their careers and who have not reached the top of their careers are more inspirational for young people, because they can see themselves at that point, whereas seeing themselves as chief medical officer or seeing themselves right at the top is too far removed. So, broadening out our idea of what an ambassador and a role model are is helpful.

[164] **Julie James:** On that point, there has been a lot of research recently on this. One of you said that the stuff about teachers making assumptions about what girls would be interested in was anecdotal. There has been a lot of research just recently on ‘unconscious bias’ as it is called. I am just looking at a bit here. There is a Professor Ernesto Reuben in Columbia Business School who has just written a paper called, ‘Competing with bias’, in which there is a lot of empirical evidence on what you are saying is anecdotal. It is well worth everybody reading that, but he specifically talks about assumptions made by interviewers about skills that they are unaware of. They do not know that they are making that assumption. This is rather depressing reading, because it says that nine out of 10 times when an employer chose a poorer performing candidate, the candidate was male, because the employer had assumed that the male would be better at STEM subject skills than was in fact the case, and had assumed that the female candidate would be worse at STEM subject skills, and they did not know that they were doing that. The interviewer person—it did not matter who they were. So, a white male did that, but also females did it and ethnic minority candidates; everybody did it. It was a pervasive view across the whole platform of people doing the interviewing, which is very distressing.

11:00

[165] However, the research is very good, because it says that, if you point that out to people and make them do this test that he talks about here first—the implicit association test—they corrected themselves. So, I suppose that one of the things that I would like to see is some actual research about what we can do to help the people who are actually making decisions like that to correct their bias, if you like. You have to be aware of your bias before you can do anything about it. This piece of research I recommend highly to you. It is a very interesting point about how all of us make these assumptions.

[166] **Ms Kent:** Absolutely. I think it is a really important point. Sometimes, when you start talking about gender issues, it can become a woman’s issue and become alienating and separate. Actually, it is not about that at all; it is about all of us, absolutely. I have become aware of that since joining Chwarae Teg, much more than I was in the past. We all have

unconscious bias because we have all grown up in a context with that.

[167] **Julie James:** He makes a forcible economic argument that the firms that overcome it do a lot better economically than the ones that do not. So, it is not just about fairness.

[168] **Ms Kent:** Absolutely.

[169] **Ms Richards:** I would add that this is about taking that to create the sustainability of change, and that we do need to start, as I said earlier, from a very young age to build understanding among those that have an influence on the next generation that we do, naturally, as people, all hold stereotypes. That is a human concept; that is normal for all of us. We need to be able to challenge those, and the work we are doing with teachers is about understanding that we all have an unconscious bias, how that pervades into the child's perspective, and, also, how they can challenge that in an open and constructive way. We feel strongly that by starting the work early—as well as the other interventions that work at different levels of education and employment—you can create that longer term sustainable change.

[170] **Julie James:** If I may just make one last remark, Chairman, I was taught at university by a woman called Dr Cora Kaplan—some of you may have heard of her. She had a test for areas of society to find out whether they had become equal, and that is that you knew that an area had become equal when there were as many mediocre women in it as there were mediocre men. [*Laughter.*] However, that is actually a very good test and addresses that point that I think Alice was trying to make. You can change 'mediocre' to 'normal' if you like—that is, not high flyers.

[171] **Ms Kent:** I understand what you are saying, definitely.

[172] **Ms Gray:** On your last point, in terms of addressing school-age children, there was an interesting bit of research about maths and science exams. If the students are asked to fill in a box as to whether they are male or female before the exam, the females actually do worse because they are reminded of the stereotype that they are not going to do well. It is interesting how that combines the stereotype with how it affects children from a young age, and how it could potentially put off half the population from pursuing or doing well in STEM. I find that really fascinating.

[173] **Ms Kent:** Alice's specialism is neuroscience.

[174] **Joyce Watson:** On unconscious bias and stereotyping, if we look at the police force, and I know that we are not looking at the police force, as an area that was forced—no pun intended—to do something about its gender disparity, it would be fair to say now that girls might think that they could be policewomen, whereas they would not have thought that, say, 20 years ago. In fact, I can go back to 1992, when I was on the Dyfed-Powys Police Authority, and it had this wonderful launch for its force, as it was called at the time, without a single female in the picture. It had to redo it, because I was there and I made it do so. The point I am trying to get to is that that has broken down, in some ways, perceptions. I am not saying it is absolute that females belong in the organisation that is the police service. So, why is it, in your opinion, that the same thing has not happened—I am not giving them as the best example, I am giving them as an example—in other areas, like, for example, construction, where they make up only 1%, yet again, and have done for that last—well, have done. That is it, full stop. When do we get to that tipping point? That is what we are talking about. Why have we not reached it in STEM, when we have in other places?

[175] **Ms Kent:** From my perspective, it goes back to that unconscious bias. It is about that

idea that we still have in our society, and in many other societies in the world, that women are carers first and earners second and that men are earners first and carers second. That is at the heart of this. That then translates all the way along our lives. There is some research by Professor Tom Schuller, which is called *The Paula Principle*. In his research, it says that girls start making decisions around careers in their early teens, based on the fact that they might, at some point in the future, have children. They assume that, if they do, at some point in the future, have children, they will be the main carer, so they will be looking for a job that facilitates that. That is before they have met someone and before they have decided whether they are going to have children. Really early on in their lives, they are starting to think of their future in those terms—‘my first and foremost role in society will be as a mother’. I am sure that that is not conscious, but that is influencing their decisions, it is influencing what their parents are saying to them, it is influencing what the schools are saying to them, and it is influencing what the media are saying to them. That is at the heart of this and that is what we need to tackle. Similarly, conversely, boys have the idea that, at some point in the future, they will be the main breadwinner and need to provide for a family. So, their career and their income levels are going to need to be greater, because that is their expectation and society’s expectation of them. It is like that question: if an alien came and looked at us, what would they think? In a sense, we are saying to half the population, ‘Your financial independence and earning a wage to be responsible for your financial security are not quite as important as it is for the other half of the population’. So, it is no surprise that we see men and women segregated into jobs where there is a decent salary and decent career progression for the one who has subconsciously or unconsciously accepted this role as breadwinner. Then, there is the one who has unconsciously accepted this role as carer. That is at the heart of this and that is why we cannot attack it with one thing with one group of employers or in one sector, because that is what the issue is.

[176] **Ms Gray:** Also, building on that is the nature of science itself, and STEM itself. A lot of it is outside of normal working hours and it is often very unsupportive for working parents. For women, who often undertake the caring role, that can be an issue. So, it is important, as well as attacking from several angles, to incorporate supportive structures for working parents, because in science everything moves so fast that, if you take a career break, you are left behind, and women are much more likely to take a career break than men, especially due to family. So, supportive structures and training would be really important for women in STEM, because, if they were to take a career break, they could be left behind within a matter of years. It is the nature, as well—. As you said, it is a multi-factorial problem that needs addressing.

[177] **Ms Kent:** I think that the response to that is an interesting one again. What we have done, in some ways, is—. One of the ways in which we have responded to this carer/earner divide is to say, ‘Well, employers then, need to change to allow women’—we have not said ‘somebody’; we have said ‘women’—‘to juggle and to balance and to take on both roles’. Actually, what we should be saying is that we want to get rid of the divide and that we should be able to balance work and other responsibilities. I think that we would make more progress on that if we put more effort into encouraging and supporting men to feel comfortable with taking on more caring responsibilities.

[178] At Chwarae Teg, it is obviously about women achieving and prospering, but we absolutely recognise that there are lots of men out there who grew up in families where they hardly ever saw their fathers and who want to be much more active and engaged fathers, and because we still have this earner/carers divide, they have the pressure of being in work, having to work long hours and having to be the provider, which is not where they want to be either. Actually, in this day and age with the technology that we have and the type of economy that we have and the kind of roles that we have, there is absolutely no reason why we cannot change the way that we live our lives and balance those two things and not expect one part of the population to take on an extra burden in either arena.

[179] **William Graham:** Joyce, do you have a final question?

[180] **Joyce Watson:** Yes. I would like to ask who you think should be responsible for providing the support structure to assist working parents or carers working in STEM occupations. That follows on quite nicely from where you have just left off.

[181] **Ms Kent:** Yes. I suppose that this is really the holy grail, is it not? This balance of care and work is fundamental. I think that there is a lot that we can do by changing how we work. We have the technology to be able to do this. I think if we just bring our ideas about how we work into the twenty-first century, so that we are not about presenteeism, but about getting the results—. If employers focus on, ‘What is the result that I want from this person?’ and give people freedom to get on with delivering that result, I think we would be able to balance the different aspects of our lives much more effectively. That is something that we have worked on a lot in Chwarae Teg. We are reviewing everything that we have looked at and are looking at a new concept at the moment called ‘results-only work environments’ to see whether that is part of the solution here. Whenever you survey women, they will say that affordable, accessible childcare is the biggest barrier to contributing to the workplace fully. I think that it is one step back from that; I think that it is that person being the person who is taking on responsibility for providing that childcare that is the real barrier. However, for both parents, having access to childcare and having an employer who is sensible and modern and realises that it is not about being there on the dot at this time and leaving at that time, but actually getting the job done, would go a long way to achieving this. This applies across all industries and sectors, really.

[182] **Joyce Watson:** May I press you further on that?

[183] **William Graham:** Very quickly, Joyce, because we are at the end of our time.

[184] **Joyce Watson:** Yes. There is anecdotal evidence with regard to mothers returning to the workplace that, very often, they are either forced out or sacked as a consequence of not being able to meet their work obligations given their parenting obligations, because the child might be sick or the hours do not suit. Could you point us—because we do not have time now—towards any of that?

[185] **Ms Kent:** To instances where that has happened or—

[186] **Joyce Watson:** To research where that has been brought forward.

[187] **Ms Kent:** I will take that back to the research team and we will see whether there is anything that we can provide on that.

[188] **William Graham:** Thank you very much. Unfortunately, time is against us and has beaten us today. Thank you very much for your evidence. There will be a transcript of today’s evidence session provided if you want to check that. Thank you very much for your attendance today.

[189] **Ms Kent:** Thank you very much.

[190] **William Graham:** We will break for about 10 minutes and then start our last session for today.

*Gohiriwyd y cyfarfod rhwng 11:15 ac 11:23.
The meeting adjourned between 11:15 and 11:23.*

**Ymchwiliad Dilynol i Sgiliau Gwyddoniaeth, Technoleg, Peirianeg a
Mathemateg (STEM) (Sesiwn 3)
Follow-up Inquiry into Science, Technology, Engineering and Mathematics
(STEM) Skills (Session 3)**

[191] **William Graham:** I welcome our witness this morning. Thank you very much for your attendance. For the information of Members, both e-skills and SEMTA, the Council for Science, Engineering and Manufacturing Technologies, were invited to come today, but they declined our invitation. We are very grateful that our witness is with us today. Could I ask you to give your name and title for the record?

[192] **Ms Griffiths:** I am Donna Griffiths, and I am a skills strategy manager for CITB Wales.

[193] **William Graham:** Thank you for your evidence. I am going to ask the first question, if I may. Would you care to expand on the views expressed in your evidence that there is a failure in basic skills in primary schools and the effect that that has on further and higher education?

[194] **Ms Griffiths:** The evidence that we have has come through the Estyn report, as well as anecdotal evidence and the views of employers. As the industry training board, we represent around 10,000 construction employers—so, a significant number—and their views are that, when they are taking on apprentices, the level of basic skills is particularly poor. We do a test to get on to the apprenticeship course, and some of the pass rates are not particularly good. However, we do have a strong apprenticeship programme, and, built into that, we cover some of the basic and key skills. That requires additional funding because there is an additional cost to cover those basic skills and get them up to scratch. Evidence from employers suggests that, at that starting stage, they are quite poor at those basic skills—English and maths.

[195] **William Graham:** In your opinion, it is principally literacy and numeracy being at an unacceptable level to commence the course, presumably.

[196] **Ms Griffiths:** Yes.

[197] **William Graham:** Would science come in at all on that?

[198] **Ms Griffiths:** Predominantly, the skills relating to the apprenticeship qualifications are around English and maths. The type of maths covered would be calculations, angles, percentages and that type of thing.

[199] **William Graham:** Eluned is next.

[200] **Eluned Parrott:** Thank you. I want to ask a little more about the issue of maths skills and in particular the assertion in your evidence that you are concerned about the introduction of an additional maths GCSE and the impact that that will have. Can you talk me through that? Clearly, the idea of the new maths GCSE is to improve these numeracy skills, so why do you think that this is not a good way forward?

[201] **Ms Griffiths:** Although we think that the qualification is a good idea, our concerns are predominantly around the availability and ability of teachers to teach those additional qualifications. Our concern stems from the idea that the teachers will be taken away from students who have the most need. Those are the ones who are most likely to come into our sector. Therefore, they will be leaving a gap because the additional qualification will require

additional resource.

[202] **Eluned Parrott:** However, do you think that this is a problem at the GCSE stage? Really, this is a problem that should be tackled much earlier on in someone's school career, is it not?

[203] **Ms Griffiths:** Yes, it is. Further on in our evidence, we suggest that, predominantly, we have concerns around primary education where we feel that the STEM skills are not being taught and evaluated as they are in secondary education and further education.

[204] **Eluned Parrott:** You mentioned FE institutions and work-based learning providers raising concerns about standards of numeracy. What role are they currently playing in bridging that gap and how appropriate is it for them to be the people bridging that gap?

[205] **Ms Griffiths:** We very much see this as something that should be dealt with in primary school. We do not think that it is being done adequately and we do not believe some of the anecdotal evidence that suggests that individuals lose some of this information and knowledge in secondary schools. We think that there should be a lot more done in primary schools. As I mentioned, we do pick up on basic skills and key skills within the apprenticeship framework, but that is at an additional cost. So, we think the costs could be reduced if basic skills and STEM subjects were taught more and perhaps better at primary school age.

[206] **Eluned Parrott:** There is an alternative school of thought that says that, for example, literacy and numeracy rates of children coming through primary schools, as they leave key stage 2, are not bad but that what happens is that little or no progress is then made in key stage 3 during their first few years in secondary school, before the focus on exams. Do you disagree with that assertion, then? What evidence do you have to suggest that it is the primary school level that is the problem there?

[207] **Ms Griffiths:** There is an awful lot of reporting done by Estyn at secondary school stage and again in FE around those areas but, as we say, there is not as much scrutiny in those particular subjects in primary schools.

[208] **Eluned Parrott:** Okay, thank you. Finally, what work are the FE institutions and work-based learning providers doing in terms of talking to schools about the kind of skills they need young people to have in order to get them through apprenticeship programmes and those sorts of courses successfully?

[209] **Ms Griffiths:** We work with the careers service, we work directly with schools and we work with Welsh Government on developing qualifications. We are trying to ensure that some of these are built in. We have been working with WJEC and we will be looking at launching one new qualification in September. We have developed three new qualifications in total. We also see that the Welsh baccalaureate is going to be something that we can utilise to explore these concerns more. Perhaps, once we start to use that, we will see some different results.

[210] **Eluned Parrott:** Okay, thank you.

[211] **Rhun ap Iorwerth:** May I just come in on that?

[212] **William Graham:** Yes, please do.

[213] **Rhun ap Iorwerth:** Can you expand a little bit on what the new revised Welsh baccalaureate might be able to offer?

11:30

[214] **Ms Griffiths:** I cannot give you any further detail because it is not my area of knowledge, unfortunately. We have a careers and qualifications manager who deals with that. However, he and his team have been working closely to develop something with the employers, and I think that that is key. We have been working with a large group of employers through our qualifications group to ensure that what we have created is actually something that the employers want and that the schools and providers are able to deliver.

[215] **William Graham:** I now turn to Sandy.

[216] **Sandy Mewies:** Thank you, Chair. You have already referred to the fact that the Estyn report discussed failure to develop literacy and numeracy skills. I think that you have touched upon difficulties in the transition changes between institutions, but Estyn also said that career guidance is often unclear and misdirected and that it refers learners who are mostly less able boys to construction and craft training as a suitable career choice. Given that, do you think that it is true, and do you think that that is the wrong thing for them to do? If you do, why is it the wrong thing for them to do? It is not just less able learners, according to Estyn, but youngsters who are more disruptive. So, do you have evidence of that? Is that something that you see?

[217] **Ms Griffiths:** Yes, we do. Predominantly, the apprenticeship intake is male dominated and it is made up of students who are probably less able. That is the traditional apprenticeship route. We have worked with employers across Wales to develop a shared apprenticeship scheme, which takes in students at a higher level and aims to take them in so that they are able to achieve an A-level. So, they are obviously at a higher level, and then they achieve at NVQ level 3. Construction apprentices traditionally are level 2, and the shared apprenticeship scheme has been a huge success in that area. There is very little drop-out, and it is now running in three areas across Wales. So, we do have pan-Wales coverage with three different shared apprenticeship schemes.

[218] **Sandy Mewies:** Does this also link in with what you were talking about in terms of the lack of basic skills? It may be that not all of them will be less able, but it will be that they just have not either learned or been taught basic skills.

[219] **Ms Griffiths:** Again, we have anecdotal evidence that suggests that advice from careers advisers and teachers, for those who are less able and are more disruptive, is that the obvious and suitable career choice should be a construction apprenticeship. However, as the industry training board and sector skills council for construction, it is our aim to use construction in order to demonstrate that it is a really good career pathway and that there are significant careers to be had. Without construction and the built environment, we would not have the room that we are sitting in, we would not have roads to travel on, and we would not have the schools that they are taught in. So, it is about a positive image, and it is about changing people's aspirations and the view of the construction sector.

[220] **William Graham:** I now call Mick Antoniwi.

[221] **Mick Antoniwi:** Coming on to the construction sector and further education in construction, craft and so on, how satisfied are you with the adequacy of the skills of those in the teaching profession in delivering what you require and what employers require?

[222] **Ms Griffiths:** We work very closely with all of the further education colleges that deliver construction training. We sit on a number of best-practice groups—or we have put together a number of best-practice groups that work with the providers, work-based learning,

and FE college providers, so that they are able to share knowledge and best practice. We have also established the Wales qualifications group, which looks at developing new provision and looks at the capacity and ability of different providers to provide in certain areas.

[223] **Mick Antoniw:** Do you get any feedback from employers, as I do, that there is quite a high degree of variability, that is, quite a number of people are going through these courses and coming out without sufficient practical skills to go into the trade early on?

[224] **Ms Griffiths:** Yes. The common complaint that we have from our employer groups is that—. An apprenticeship is known as a level 2 qualification; however, there is a general feeling that the minimum apprenticeship qualification should actually be a level 3. That ensures that the individual does have more experience, is more able and has a broader variety of skills, perhaps going back some years to the old type of master craftsman or master builder. However, they come out at a level 2.

[225] We also have some concerns that there is some significant provision at level 1, which then does not always lead to a pathway into an apprenticeship scheme. I think that that is really where our concerns are, rather than, predominantly, with level 2, which we see as adequate; however, we would like it to be, at a minimum, level 3. Our concerns are the number of student apprentices who are studying at level 1, who do not actually have any career pathway or progression into level 2 and believe that they are competent and qualified. Some of those may never enter the industry, but those who do, perhaps, sometimes assume that they are competent and qualified, which is not the case.

[226] **Mick Antoniw:** Just to clarify, what would you say needs to be done to rectify that situation?

[227] **Ms Griffiths:** Our employers would suggest that to term a qualification an apprenticeship framework, it should be a minimum level 3 NVQ.

[228] **Mick Antoniw:** Okay, thank you.

[229] **William Graham:** I call on Rhun.

[230] **Rhun ap Iorwerth:** Your written evidence suggests that, when it comes to work experience placements, quite often employers in the construction industry run a mile. What is the problem with the way that work experience works now, and what kind of steps have been taken positively to address that?

[231] **Ms Griffiths:** The work experience programme currently is quite inflexible, and the construction industry perhaps needs a little bit more flexibility in what it can actually offer. If it is taking people on for work experience, a lot of considerations need to be made, like health and safety. Things like weather would be an obvious barrier to some young people going out on a site. I think that it is around the inflexibility of work experience and the types of students who are suggested for work experience on our sites, which goes back to the lower level student.

[232] **Rhun ap Iorwerth:** So, what kind of measures can be brought in to make it better, to make sure that the industry gets engaged more with young people at younger ages?

[233] **Ms Griffiths:** We have done some good things through the pathways programme, and we also offer, as an organisation, through our employers and our grant scheme, incentives for work experience, but I think that employers need to work more closely with Careers Wales to develop something that is more suitable for our particular industry, and is not such a broad-brush approach to work experience.

[234] **Rhun ap Iorwerth:** However, work experience is something that you see as being vital in order to draw people in.

[235] **Ms Griffiths:** It is, yes, just to try to demonstrate the different scope of qualifications and careers that are available, because the majority of people's view of construction is that there are four trades: plastering, bricklaying, carpentry, and painting and decorating, and that that is where it ends. However, our aim, through work experience programmes and through the Positive Image campaign, is to try to expand people's views of the industry, of what it can offer and of all the different types of occupations that are available. The industry has changed massively over the years. When you look at off-site manufacturing and the green industry, they all have huge impacts on the industry and the types of roles and jobs that are available.

[236] **Rhun ap Iorwerth:** So, in the same way as you have lower-level and higher-level apprenticeships, we should be developing higher-level work experience placements as well.

[237] **Ms Griffiths:** Yes.

[238] **William Graham:** I call Joyce Watson.

[239] **Joyce Watson:** So, what you are really saying, Donna, is that there is a perception that permeates the thinking of the teachers, the schools, the colleges, perhaps, in some respects, and also Government about construction being nothing but a low-skilled workforce, and that has to be a massive challenge, because if that is already in people's psyche, when they present the industry to young people as a career, it does not really, in my opinion—and I will ask you for your opinion—bode well for attracting all the people we need to that particular career. So, that being said, what sort of level of engagement or effect have you been able to have on the education-business partnerships since Careers Wales became a wholly owned subsidiary of the Welsh Government?

[240] **Ms Griffiths:** When Careers Wales was a series of different companies, each worked very differently, but all had individual funding allocations for specific types of activities, and that is something that has dried up, really. We used to work very closely on school engagement and on school activities—we used to provide challenges and ambassadors. I think that that has definitely dried up and is not as active as it was in the past.

[241] **Joyce Watson:** And yet, we have had evidence to the contrary, I have to tell you, from the newly formed Careers Wales, namely that it has a wonderful programme that is working extremely well.

[242] **Ms Griffiths:** I do think that the changes that have been made have been positive ones. However, it goes back to the society issue, and I think that the industry and industry bodies need to work more closely with careers advisers and perhaps a CPD programme for careers advisers, because it is their mindsets and the mindsets of parents that we need to change, perhaps to educate them through a series of awareness-raising programmes or modules about the industry.

[243] **Joyce Watson:** I am just wondering: as a sector skills council, which you clearly are—construction—how are you going to meet the challenges that you have? There seem to be two, as far as I am concerned. One of them, you will know, is gender and the fact that 1% of your total workforce is female. The other is selling construction, which can only be described, if you describe correctly, as a form of precision engineering, because if you do not build a wall right, or you do not have the exact match on any woodwork, the roof will cave in and the stairs will fall down, and all the rest of it. So, that gives an idea of the precision required. How are you, as a skills sector, going to overcome the challenges out there in those

two areas: selling a wide range of skills that are needed and the value that should be accorded to them in the construction industry, thereby changing the face of it, and also—and I suppose that it has to be connected—encouraging more females, if you can, into the trade?

[244] **Ms Griffiths:** As I mentioned, we do have a marketing campaign—the Positive Image campaign—in which we are trying to address some of these issues. We work in schools and in colleges and universities. We look to support actual individuals who are BME and/or female, in the industry, because they are very under-represented in both of those respects.

[245] We do have a Be Fair framework. We avoided using the word ‘diversity’ because we felt that our industry was fed up with that word, so we came up with Be Fair, which is about fairness, inclusion and respect—it tackles those. It is a new programme that we are launching in June. It has been piloted with 40 companies. A number of those are Welsh companies. It is about achieving a standard. The standard is gold, silver or bronze, and it is about looking at people’s methods and processes. So, it is actually looking at what a business does, how a business can support individuals and how we can make those changes.

11:45

[246] **Joyce Watson:** Julie, did you want to come in?

[247] **Julie James:** Not really, Joyce—I think you have covered most of it. We are just talking about the gender imbalance generally and how early in life you have to start to address some of the issues that mean that women do not choose particular career structures.

[248] **Ms Griffiths:** Yes. It was interesting watching the previous session. I tend to agree that it should be done at a primary age. Our feeling is that it should be done within primary schools. Evidence suggests that children are making those decisions earlier, but it is around society as a whole—it is not just in schools; it needs to be done with parents and everyone who has an influence on young children. However, we feel we could positively do more at a younger age and that it should be from the foundation stage onwards.

[249] **Joyce Watson:** There is one final question from me, which is about this perception of there being lower-end skills in the construction industry, yet we see major projects and major buildings right across, and they are magnificent buildings that take huge amounts of skill, which is all part of the construction industry. So, I suppose my question to you as the construction skills council is this: how can we and you help young people to see it that way, rather than the current perception that it is Bob the builder, not Babs the builder, picking up a brick, putting on some concrete and the job is done?

[250] **Ms Griffiths:** Again, it is about raising awareness of the image of the sector and what it can achieve, and having flagship buildings and champions of individuals who can act as ambassadors for the sector. We have a successful ambassador programme where ambassadors go into schools, and provide information and advice on what they are doing and how they have achieved what they have achieved. However, linking back to the earlier debate, they are limited in numbers of females. You get the general impression that they are reluctant sometimes to be used, and that they are reluctant because they are used so much, because they are so limited in numbers.

[251] So, it is about raising the attainment levels of apprentices so that it is seen as a professional workforce. It is down to the industry to ensure that its health and safety records are exemplary and that the industry is clean and green—all of those things that would put off youngsters from entering the industry that we need to change. The Be Fair framework goes some way towards doing that.

[252] **Julie James:** On that point, it is a slightly weird thing to say, but I recently tried to find a firm that employed female craftspeople to do some work on my home. It is impossible to do—you have to ring every firm. Have any statistics been compiled on that?

[253] **Ms Griffiths:** On female-only firms?

[254] **Julie James:** Not just female-only firms, just a firm that employed any female craftsperson.

[255] **Ms Griffiths:** They are few and far between. As Joyce has already mentioned, the numbers are particularly low. One per cent of the construction workforce in Wales works in manual trades. One per cent of 100,000 people is very small. What we have been attempting to do to try to tackle some of this, recognising that much of the work on STEM relates to recruitment and attracting more women into our industry, is turn that on its head and look at actually retaining those women. Our figures suggest that any female that enters the industry is likely to stay in the industry for only around five years—and they are not all leaving to have babies, never to return. There is a huge issue about how they can return, due to working practices and time, as the industry has a very mobile workforce. However, there are good companies out there that offer really good return-to-work packages. We need to look at broadening that. There are a number of other factors, which were highlighted in a recent Chartered Institute of Building report, which looked at the glass ceiling but also at the glass wall of the construction industry, and how people—women in particular—are not able to break through those. So, there is evidence out there that backs up that point.

[256] **Julie James:** I am just wondering whether the good firms that you are talking about could be encouraged to use it as a marketing tool. I, for one, would happily employ somebody for that reason alone.

[257] **Ms Griffiths:** The issue is that the good companies that are using it are larger companies and would not be domestic companies.

[258] **Julie James:** So, you are talking about the big construction companies.

[259] **Ms Griffiths:** Yes, rather than domestic companies.

[260] **Julie James:** That is depressing.

[261] **Ms Griffiths:** Yes, it is.

[262] **William Graham:** I will ask you the last question, if I may. What is the level of demand for Welsh-medium training from learners, and is that influenced by the lack of bilingual teachers?

[263] **Ms Griffiths:** Sorry, I will just have to refer to my notes.

[264] **William Graham:** If you have no particular opinion on this, we fully understand.

[265] **Ms Griffiths:** Other than what we have already submitted, I have nothing to add to that, thanks.

[266] **William Graham:** Are there any other questions from Members? There are not. Thank you very much, Ms Griffiths, for your evidence today. A transcript will be sent to you in due course for checking. We are most grateful. Thank you very much.

Daeth y cyfarfod i ben am 11:52.
The meeting ended at 11:52.