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Oral EVIDENCE

TAKEN BEFORE the

Science and Technology Committee

Engineering Skills

Wednesday 21 November 2012

Dr Bill Mitchell, Nigel Fine and Dr Matthew Harrison

Carole Willis

Elizabeth Truss MP and Matthew Hancock MP

Evidence heard in Public Questions 132 - 227

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Oral Evidence

Taken before the Science and Technology Committee

on Wednesday 21 November 2012

Members present:

Andrew Miller (Chair)

Caroline Dinenage

Jim Dowd

Stephen Mosley

Graham Stringer

Roger Williams

Examination of Witnesses

Witnesses: **Dr Bill Mitchell**, Director, BCS Academy of Computing, **Nigel Fine**, Chief Executive, Institution of Engineering and Technology, and **Dr Matthew Harrison**, Director of Education, Royal Academy of Engineering, gave evidence.

Q132 Chair: Good morning, gentlemen. Thank you for coming in. We have a very busy agenda, with three sets of witnesses this morning, so we are going to steam on, but it would be helpful if the three of you would be kind enough to introduce yourselves, for the record.

Nigel Fine: Good morning. My name is Nigel Fine. I am here in two capacities. I am the chief executive of the Institution of Engineering and Technology, which has 150,000 engineers and technicians around the world, and is also a large scientific publisher. I am also here representing the other 36 engineering institutions that, together with the Royal Academy, Engineering UK, the Engineering Council and the Institute of Physics, form E4E, the body that articulates our position on engineering education.

Dr Harrison: Hello. My name is Matthew Harrison. I am director of engineering and education at the Royal Academy of Engineering, the national academy for engineering.

Dr Mitchell: Hello. I am Bill Mitchell. I am from BCS, the Chartered Institute for IT, and I am director of the Academy of Computing, the Learned Society arm of BCS.

Q133 Chair: Thank you very much. First, Mr Fine, you mentioned E4E, but I would be interested in a response from all of you. Obviously there are a very large number of learned societies in the engineering sector, but what is it that E4E has achieved and can achieve that you could not have done alone as individual organisations?

Nigel Fine: We do an awful lot individually, as you know, but the ability to bring the profession together through a single co-ordinated voice and to articulate exactly what the

profession's position is on matters of education, learning and skills, to be focused in that communication and to be joined up in our approach to disseminating that information to a wider audience, is very much at the heart of what E4E is doing.

As for whether it is making progress, I think that it is. It is certainly making a larger community aware of the importance of skills and of the skills shortage in the engineering profession, and the things that we-the Government, industry and professional engineering institutions- must do collectively to address the problem. I shall take one particular example: the Engineering Diploma, of which we are extremely supportive. E4E has been extremely focused in working with the Government and other organisations to get it back into the educational syllabus, because we think that it is an important part of what young people need to have as part of their learning experience.

Dr Harrison: That is one great example. I would like to offer another. The first thing that E4E did was to look at what is happening with STEM in the further education system. For nearly 10 years, and rightly so, successive Governments have had a focus on science, technology, engineering and maths. It has happened in schools, with a focus in schools, and we have seen numbers rising in A-level physics, A-level chemistry and A-level maths, which is excellent, and there has been a focus on higher education-but further education, which provides so much of the skills base for this country, was omitted. As institutions, we just couldn't find out how many folk were studying STEM qualifications in the FE sector. The Government couldn't tell us either, so the first thing that E4E did was to make a very coherent case on the need for data. That produced a thing called the FE STEM data project, which brought real clarity to that important part of the education system.

Dr Mitchell: The reason why I see it is as really important is the fact that we have a unified voice on various topics. The most important example from my point of view is that, 18 months ago, it looked very much as if the Government were likely to withdraw ICT altogether from the school curriculum. Obviously, the BCS saw that as a very bad move, but working with E4E we were able to put forward a unified position, saying, "It's not just the BCS. There are 36 professional bodies that all believe you should not remove ICT from the curriculum." It was extremely important to have that unified voice, all putting together the same message. The fact that we could all meet and talk together meant that we could sort out what the message was before we presented it to the Government.

Q134 Chair: Just so that we understand the scale of things-Mr Fine, you mentioned the number of people who are IET members. When you were speaking as E4E, how many members were you representing collectively?

Dr Harrison: Not quite half a million.

Q135 Chair: Not quite-but it is a pretty large number.

Dr Harrison: It is a very large number.

Q136 Chair: Dr Mitchell, in the BCS you have the Academy of Computing. Would you explain its purpose?

Dr Harrison: The BCS royal charter, essentially, says that there are two purposes for the BCS. One is to promote professional standards, and the other is to promote education in computing.

The BCS Academy is very much about promoting the academic discipline of computing for the benefit of society. That is essentially why we have that sort of split in the organisation.

Q137 Chair: Dr Harrison, you have a curious relationship with the Department for Business, Innovation and Skills. You are partly funded through its structures, but you also represent the views of your members. Tell us about that relationship. Is the Department listening to you?

Dr Harrison: We have an excellent relationship with the Department for Business, Innovation and Skills. I think that it comes from our position as independent domain experts. If you want to get good independent engineering advice, a natural place to go is the engineering community. The advantage of the Academy is its fellowship of nearly 1,500 of the most eminent engineers. They are multidisciplinary and independent, so we see tremendous volunteer contributions. As our fellows walk through the door, they take off their corporate or academic hats, and even their institutional hats. They are there to offer independent advice on matters relating to engineering, which in recent weeks has very helpfully come more centre stage because of the real connection between jobs and growth, productive industry and engineering.

Q138 Stephen Mosley: Dr Harrison, in your initial response to the Chairman, you talked about the work that you have been doing on data, bringing together data on learners within the SET environment with engineering. I can see the benefits of that. Who do you think should be responsible for that overall?

Dr Harrison: This is a difficulty. There is good data for schools in the national pupil database. There is good data of a very different type for the FE system, with the Data Service. Then UCAS and HESA have higher education data. What is difficult is that it is impossible to make a link between what happens in schools and what happens in FE and HE, because we do not have a longitudinal tracking ability. Why that might be important is that we, as a profession, have invested for a very long time in reaching out, particularly to young people, and making a case for engineering careers and trying to inspire the next generation. We invest time, effort and cash, and we work in concert with the Government to make sure that those who have had their aspirations raised can get access to the right sorts of courses, curriculums and qualifications, and progress. Until we have a real understanding of what works in terms of progression in STEM and, crucially, progression into STEM careers, we as a nation cannot start to make very rational decisions.

Two things need to be done. The first is to make the data more accessible. When we wanted to know more about the FE system, E4E had to push really hard with BIS to make a positive case and get the stuff released. It is excellent now that it is out, but more people should know more things about it. I'll give you an example. An E4E report looked at the combination of maths and science taken by 16-year-olds. Only half of our 16-year-olds achieve that very important combination of at least a C grade in mathematics and at least two science GCSEs at grade C. It varies strongly around the country, and it starts to look a bit like a postcode lottery, where parts of the country have surprisingly low levels of participation in this combination of STEM subjects and other places are much higher. When we think about the labour market, those are the sorts of pieces of information that parents really need to know, because this is their kids' futures. As for the work that we have done on FE, we have a report coming out next week showing that, for school sixth forms, 49% of qualifications are in STEM subjects. That is brilliant, but in FE colleges, for young people the figure drops to 30%, and for adults it drops to 20%.

The message is really clear: if you are a young person, get engaged with STEM and be successful with STEM, because the chances of re-engagement as an adult are so much lower. It is a real problem for us trying to find sustainable growth in our economy because, of course, it is our adults who provide the muscle to get that growth. Of those adults who are engaging in further learning and training, 80% are outside STEM, and it is that 20% that needs to grow.

Nigel Fine: May I add another point on data? A system was set up-a big investment called the unique learner number-and a large amount of money has gone into that. That would assign a reference number to all children from the age of four, which would stay with them right through their education and through to employment. That would be a magnificent way of tracking progress, and the data associated with individuals as they went through their educational programme, but it has not been launched. It has not been implemented, although a lot of money has been spent on it. We are at a loss to know why the money has been spent, but it is not being used as a system to enable us to capture the data that will help us track the progress of young people through the education system.

Q139 Stephen Mosley: It was called-

Dr Mitchell: Unique learner number.

Q140 Stephen Mosley: That is something for the Minister later, I guess.

Nigel Fine: I think so. We understand that about £15 million to £20 million has been spent on it. It is a lot of money.

Q141 Stephen Mosley: Moving on to careers and the labour market, what do you think the skills gap is in the UK? What sectors are worst hit, and what evidence do you have to back that up?

Nigel Fine: The IET publishes a report every year called *Skills and Demand in Industry.* We have been doing this for six years now, so we have very good historical information regarding the skills gap in industry today. The positive news is that employers are actually quite optimistic about the future, and are looking to recruit engineers into the work force. The problem that they have is finding engineers to fill the jobs that they have, and that they expect to have increasingly in the future. The challenge is to ensure that the young people coming through have the skills-mostly around practical experience-to enable the employers to want to use them and to get them to work effectively in the jobs that they have. We have evidence that there is a demand, but there is a problem in filling the roles that there are today.

Dr Mitchell: There are lots of shortages of skill in the IT world. Probably one the most alarming is that 90% of companies cannot recruit people who can deal with cyber-security. That is a big problem. The Cabinet Office reported last year that £27 billion a year is lost in cybercrime. That is a huge area, and there is a critical shortage of people there. I know that GCHQ is absolutely desperate to find people with the right skills, and it struggles a lot. You could look in other areas. For example, you could talk to the folks at Tech City. There was a report by Demos last year that included a quote from one of Tech City's entrepreneurs: "There just aren't enough Computer Scientists in the UK. And we need Computer Scientists, we don't need-what do they call it-ICT trained people. We need real Computer Scientists

who do software engineering and programming." That is just one example from an entrepreneur.

This is alarming, because other research shows that companies that are IT-intensive are 25% to 30% more likely to grow in terms of employment. At the moment, I imagine that that is rather important. There are other data from EUROSTAT showing that, roughly, the percentage of the UK work force that has specialist IT skills has been bumping along at a relatively constant rate, whereas if you look at the European countries, in all 27 of them the percentage of the work force that has IT skills has been slowly but steadily increasing, even through the recession. If you look at Germany, the rate of increase is significantly higher compared to ours, in terms of the proportion of the population in the work force with specialist IT skills. If you also look at data from BIS, it shows that the number of jobs that are going to require specialist IT skills is increasing at four times the average rate of other jobs in the economy. That suggests that there is a growing skills gap in the IT profession.

Q142 Stephen Mosley: Okay, if we have a skills gap-it seems that all of you think that there is-how are we currently filling it?

Nigel Fine: There are a number of things that we are doing. Really, you have to get back into the educational base. It is all about inspiring young people to stick with STEM subjects, which will give them the options to choose a variety of careers, with engineering, science and computer science being among those options. If we do not encourage our young people to do the STEM subjects, they will not have the basic capabilities to go on to do programmes of education and careers that require STEM education.

There are a lot of things that we are doing. The profession has a number of programmes. For example, the Big Bang Fair-Andrew, you came along to that a couple of years ago in Manchester-is organised by the whole profession. It includes industry as well, with Government support. It ensures that young people, and their parents and teachers, who are big influences on young people deciding on their careers, can have a great experience, and come along and understand what it is that engineers and engineering are all about. Statistics show that when young people have been through those programmes-they are really not about marketing, but about helping to fill the skills gap-there is an increasing awareness, and a positive awareness, of the value of the engineering profession and a career in engineering. We run another programme called Tomorrow's Engineers. Again, the engineering profession is coming together with industry in an outreach programme around the country, putting on a series of events that bring engineering into the lives of young people, to explain the variety of engineering activities that there are and the diversity of opportunities. The programme is all about inspiring people.

Q143 Stephen Mosley: Those are all long-term plans. In the short term, if you are an employer looking to employ skills now, where do you go? How do you fill that gap now?

Dr Harrison: We have a university system that attracts students from around the world because it is seen as world class, and engineering is a prominent part of that, which is fantastic. We also have more than 650 providers of engineering education and training in the FE system, which is a very large number, but they are not as visible to a lot of employers. We have rising numbers of apprentices, which is excellent, but if you look at the apprenticeship programme and its rapid development, the big rises are coming in areas outside engineering and outside STEM. As an employer, you have a graduate choice that is well understood.

Employers understand our university system and engage really deeply, so you see employers, particularly large employers, finding a synergy between the investments that they make in research in our universities and the skilled people that they seek, and that is really great. We also have an apprenticeship system that is growing-but in between those two there is very little that is codified. As an employer, if you are too small to already have a deep relationship with a university, based on your research, and you are possibly too small to see apprenticeship as affordable and practicable, then you are into direct recruiting. Our English system has lost its focus on the rather simple thing of young people going to school, getting qualifications and a broad education, and then transferring to work. It is in that area that we could do more.

Nigel Fine: May I give two more examples? The profession spends an incredible amount of time accrediting university programmes to make sure that they are delivering the training and experience that will make graduates suitable to go into workplaces. It is a very important part of what we do in the UK to try to ensure that there is a good match between supply and demand. One other example is that the profession, including the IET, works with industry to put together an opportunity for young people who want to study certain programmes where there is a shortage of skills. They are incentivised to do that-which means that there are grants to support them during their education, and work experience during their summer vacations so that they get the experience, and money to support themselves through their studies. That is a very positive interaction, in this case between the IET and the power industry, to get young people to study power engineering, where we have a skills shortage. That is happening today.

Chair: The noise outside has now subsided, but apparently it was the Chancellor of the Exchequer. We could have gone out and lobbied him, perhaps.

Q144 Graham Stringer: Dr Mitchell, may I take you back to something you said about a skills gap in computer science? Are the signals coming from the marketplace and the academic world helpful? My impression is that there are now fewer academic courses in computer science, and that salaries and wages are at best static, if not going down. Is that a fair comment? If it is, why is that the case?

Dr Mitchell: There is a difference in the kind of degree you can do. Students who have done a computer science degree with a placement year-so they have spent a year in industry-are generally much better paid. The stats, roughly speaking, are that graduates who go into industry after a placement year start at about £26,000, which is a good starting salary. For people who have not done that placement year, the starting salary tends to be much lower-maybe nearer £20,000. We find that employers really want people with deep expert knowledge who have the experience to apply that knowledge and turn it into business ability. One of the problems in the UK is that, if you are a fresh graduate and you have not had a placement year, it is quite hard to get an entry-level job. We have seen over the years that more of those low-level, low-skilled IT jobs have been outsourced-but that does not mean that the highly skilled jobs have been outsourced. Generally, if you are an organisation that is project-managing some outsourced IT function somewhere overseas, you will need some incredibly highly skilled people back at base who can project manage that and make sure that it actually delivers the business needs that you have.

There is a dilemma if you are a fresh graduate without industrial experience. At the moment, in a recession, companies are looking for people who have that experience, so you find it

harder to get a job, while the ones who have done the placement year immediately find that they can get into work. Ironically, having spoken to lots of people at universities, I can tell you that one of the most difficult things at the moment is to persuade students that they actually want to go on a placement year. I do not know whether that is linked to the fact that tuition fees are now much higher, and they would have an extra year of debt if they did a placement year, or whether there are social pressures-for example, if your friends aren't going on a placement year, you don't want to go on a placement year either.

Dr Harrison: I would like to build on that, with further evidence. In our "Jobs and growth" report we looked at the signals coming from the labour market for folks working in science, engineering and technology. It turns out that those who work in IT technology occupations in the labour market enjoy a 33% wage premium compared with the labour market as a whole. That is a huge percentage. The reason why employers are willing to pay that premium is that they can have really productive people, and the really productive people have that magic combination of the qualifications and the deep experience. Students who are competing to enter those occupations are competing against deeply technical and deeply experienced people. We have to do more to help our young people transition into a labour market that is built on very high levels of productivity. That is a really big ask. They cannot have a gentle start to their IT careers; they are thrown into a fast-moving profession, and enormous demands are placed on them. It is not surprising that employers favour those who have deep experience, because they are paying for that privilege.

Q145 Graham Stringer: Dr Harrison, how is the Royal Academy reworking the higher diploma in education, and when will it be available to students? How will it have changed?

Dr Harrison: There is a long back story to the 14-to-19 diplomas. I shall cut it short by saying that Principal Learning, the main technical core of the diploma, is still available now. Last night the latest list of qualifications that count for school league tables was released by the Department, and there it is: Principal Learning in engineering is there, and it is offered by multiple awarding bodies, which is a sign that there is still real value in it, and that folk want it, and-

Q146 Graham Stringer: If you do not mind my interrupting, may I ask you roughly how many schools, either as a percentage or as an absolute number, are still doing it?

Dr Harrison: The peak was 500. I do not have the latest data, but the number is falling quickly. It is falling quickly because there is no incentive for schools to offer a large qualification irrespective of the outcomes for the young people. They are devoting a day or a day and a half of curriculum time and getting the equivalent of 90 minutes in league table recognition-and we know how much the league tables matter to schools-plus the fact that Principal Learning was always designed to be taken alongside core subjects such as English, mathematics and science. It is a big ask for a school to take on such a large thing. To get to your question, Principal Learning is there, and the schools will continue work with it while we, as a broad coalition across the profession, including employers and teachers at colleges and schools, look at producing a more flexible alternative. We are taking the large qualification, retaining its content, retaining the deep employer engagement and retaining its progression value, so that employers will recognise students who have done the diploma as the sort of students who would benefit from an apprenticeship. We have employers who go out looking for diploma students to recruit on to their apprenticeship programmes. We want to preserve all of that, while giving schools the opportunity to offer all four of these linked

qualifications, or perhaps three or even two, very much alongside the core subjects, and alongside the English baccalaureate if that is what they want to do.

Q147 Graham Stringer: When will that be available?

Dr Harrison: We will finish our work in May 2013, so it will be available for first teaching in September 2014.

Q148 Graham Stringer: I suspect that I know the answer, but how has the downgrading of the Engineering Diploma affected perceptions, both those of students and generally? What has been its worst impact?

Dr Harrison: We see its impact in the numbers. We never had the time for the diploma in engineering to prove itself, because it was only in its second year when the Diploma Aggregation Service was removed. The diploma stopped at that point. We do not know where it would have got to, but it was climbing rapidly. It hit a peak, and now it is clearly dropping off. But I think that the impact was wider than that, because we have seen a drop-off in students studying other practical technical STEM subjects, such as design and technology. My concern is that the wider signalling that there should, rightly, be a focus on the basics of maths, English and science, which we would applaud, also means that the other subjects-the extra ones that fit in the English baccalaureate-are a higher priority for schools than technical STEM subjects. That is what has caused the real change, and we see that change in the falling number of students taking IT-type qualifications, the falling number of students taking design and technology qualifications, and the falling number taking engineering.

Nigel Fine: May I add that the professional engineering institutions and the employers like the Engineering Diploma? They recognise that there is an increasing need for people who have a bias towards vocational and practical training, with skills to fill the demands that industry has. The Engineering Diploma in its full form was seen as a very good way of giving a career path to those people who had a bias towards practical and vocational education and skills development-but it was not given long enough. That is the fact, and therefore all the things that Matthew said are absolutely right. As a product, in its original form, it gave a complete overall view of the things that young people needed to do to make them ready for a worthwhile career. That was very much at the heart of the original diploma.

Chair: We want to take this a bit further. Caroline?

Q149 Caroline Dinenage: Yes, and I want to ask more about the E-bac. A lot of our witnesses have said that they fear for the provision of subjects such as D and T and ICT following the introduction of the E-bac. I wondered whether the panel have any views on the Government's decision to replace the GCSE system with the E-bac, and whether there are any concerns that that might reduce provision of D and T and ICT and those sorts of skills-and, indeed, whether there is any evidence that that is already happening.

Nigel Fine: There are some very good points about the E-bac. Clearly, the focus on maths and science is very much at the heart of engineering, so encouraging young people to stick with those subjects for longer is important, but we recognise that young people need some way of applying the academic subjects in a practical manner to understand how they can be used for practical purposes. That is why we would like to see time made for the practical programmes-D and T, ICT and the Engineering Diploma-that would be seen as complementary to the more

academic parts of the proposed E-bac, which we think would then give a much more rounded education.

Q150 Chair: Do you mean within the E-bac?

Nigel Fine: If it could be within the E-bac, that would be helpful-but we want some way of making sure that the learner has the opportunity and the ability to apply practically some of the learning from the academic subjects in the E-bac as proposed.

Dr Harrison: There are some fairly straightforward solutions to some of the concerns that other witnesses have expressed. I can give you a concrete example. As a broad coalition of organisations, we have made a strong case for the inclusion of computer science in the E-bac. It is an example of a rigorous subject with valuable and valued qualifications that lead on to educational outcomes in further and higher education, but which also underpin jobs and growth. The signalling value of showing a little bit of flexibility, yet staying within the E-bac's core ethos of getting the basics right, which we all applaud-being sufficiently flexible to see technical and practical alternatives to, say, the humanities or the modern foreign language-would have enormous benefit.

We have started to see--we welcome this-recognition by the Government that there is a connection between what happens in schools, and jobs and growth. Both the Chancellor of the Exchequer and the Skills Minister, when opening and launching the apprenticeship centre at Rolls-Royce, made a very clear statement about their support for the Academy's work in redeveloping the diploma in engineering into a suite of qualifications. They could have said much the same thing about computer science. It is about our community owning the domain, taking a deep interest in what is taught and the qualifications that are on offer, and then working with the Government to insert them into an accountability framework for schools. That has a great combination of focus on the basics with focus on progression value beyond the age of 16.

Dr Mitchell: For computer science, the reality is that the E-bac is here. It is a performance measure, and head teachers are very much focused on those performance measures. Computer science, as far as schools are concerned, is a new, intellectually challenging and rigorous subject. That means that not all students will get grade C, so without a strong incentive to encourage those head teachers to embrace computer science, it simply won't get traction in schools. We are working at the moment with about 500 schools that are keen on the idea of introducing computer science, but we have about 3,500 state-supported secondary schools, and altogether there are about 5,000 or 6,000 if you include the independent sector. In order to get at least half of those offering computer science, all those head teachers need to believe that it is going to help make their schools successful if they introduce what they see as a new "hard" subject into the curriculum. Without computer science in the E-bac, we are going to struggle to get the numbers of schools to take it up that we need for the economic and societal well-being of the UK.

Q151 Caroline Dinenage: Is there any evidence to show what proportion of students who successfully completed the Engineering Diploma would have achieved an E-bac?

Dr Harrison: The rate-determining step would have been the modern foreign language. When the E-bac was first announced, lots of folk, ourselves included, went to the existing school league tables to see how many schools would have got it in the previous year. The answer

was 17%, and the rate-determining step was how many students took French, German, Spanish and so on at GCSE. That is the answer. To be more helpful, if we are trying to estimate how many students might have achieved the E-bac, there are two ways of doing it. If you look at vocational pathways to higher education-the E-bac position is about progression through education and on to higher education-15% of engineering undergraduates have gone through vocational routes, so you could argue that perhaps 15% of diploma students might have attained at that sort of level. The other way to look at it is to look at the students who achieved the highest grades in the diploma, and around 25% of students achieved the top grade or the next one. With some confidence, I would have estimated that around 20% to 25% of students could do that.

We have frequently made the case that Principal Learning, and now the qualifications that we are working on, sit naturally alongside a focus on maths, English and science. When schools are encouraged to include something like computer science or engineering as part of an E-bac, you get access to the full spectrum of students in the school. One of the concerns about subjects that are often thought to be vocational is the assumption in the minds of some that vocational means "only for students who will not be fully successful at academic subjects at 16." We have always made the case that engineering could and should make sense to the full spectrum of students, including both those who are using it only as an interesting context for their maths and science, and those who are seeking higher education in engineering or an apprenticeship and so forth.

Chair: We have already talked, Dr Mitchell, about the skills gap. We want to push you a little further on that.

Q152 Jim Dowd: I apologise for missing the first part of the session; it was a combination of gridlock at the Elephant and the inexplicable closure of Bridge street by the police. It made my morning even more complicated that it normally is on a Wednesday.

I noted, Dr Mitchell and Dr Harrison what you said in response to Graham and Caroline, but do you believe that there is a skills gap in ICT? I assume that you are going to say yes. What steps need to be taken to address the problem in the UK? What is wrong with the current provision in ICT education?

Dr Mitchell: In terms of the skills gap, what matters is how competitive the UK is. If all the other countries stopped doing IT immediately, we would not have a problem. President Obama said last year that if America wants to stay the top nation in the world it will have to out-compete and out-educate every other country on the planet. We are not the United States of America, but if we want to stay affluent and be regarded as one of the leading nations, we too have to out-compete and out-educate all the other countries in order to stay ahead. There is a problem with ICT in that context. How do we stay ahead of the race? When it was originally envisaged, 10 or 12 years ago, the ICT curriculum was very much focused on the skills people needed to use software in business. At the time that was a perfectly reasonable idea. However, it did not take account of the fact that all the other countries on the planet were also introducing that kind of curriculum. What we need is a curriculum that gives people an understanding of the computational principles, the foundations of computing, so that they can be innovative and invent new ideas-and then turn them into products.

There are two sides to this. You need the deep technical knowledge to be able to invent new technology, and you need to develop skills. You are not going to become a skilled project

manager when you are 12, but you need to start developing the business skills at that stage that are going to be helpful later on in life, so that you can become an entrepreneur and invent great new things. It is interesting to look at what has happened to Nokia over the last few years. Back in 2000 it had something like a 40% share of the mobile phone market. Now it has something like a 25% share of the mobile phone market, and it seems to be the case, at least according to its own CEO, that one of its problems is that it cannot write software. Its operating system, which was one of the core things within its mobile phone platform, has had to be ditched, and it now uses the Microsoft Windows operating system. That is a really good operating system, and a very good product, but it is not the company's own. It has lost the ability to innovate and invent new products, which has resulted in a massive collapse in its market share.

Dr Harrison: I want to add another risk warning. Our evidence shows that the wage premium for IT occupations is going up all the time because we have a shortage of folks. My concern is that we, as a nation wanting to compete internationally, need to attract inward investment. If we continue to have a paucity of skilled people, external people looking at the UK as a place to invest will say, "Well, there aren't enough people who have the skills that we require in this area, and as a result the wages are going up. It looks like a place with not enough people and high wages. Do you know, I'll go and invest somewhere else?" There is a deep risk to our country if we cannot get enough IT workers. Because of the pervasive nature of IT occupations-they turn up everywhere: in hotels and leisure, in retail, in engineering and in the health service-no sector of our economy is safe from the charge that the UK looks an unattractive place to invest, because we do not have the skills, and as a result the wages are getting higher.

Dr Mitchell: I would add one thing. One very positive thing is happening at the moment. The DFE has asked the Royal Academy of Engineering and ourselves to co-ordinate the development of a new ICT curriculum. It specifically said that it should be based on the findings in the Royal Society report this year. That report said that what we need in schools is a mixture of digital literacy, information technology skills and a deep understanding of computer science. There is a ray of hope on the horizon. If that curriculum does turn out in the way that we have so far put it together, there is some hope in the long term for improving our skills base.

Q153 Jim Dowd: Those were two very comprehensive responses. That has the great merit of meaning that I do not need ask many more questions. But just on the point that you mentioned about trying to get computer science included in the E-bac, you said that you were making progress of a kind with 500 schools or so. First, do you regard that as satisfactory and promising? Secondly, given the fact that everybody says that we need these skills in Britain, in the new technological society if not before, why is it so difficult to get them into the education system?

Dr Mitchell: Five hundred schools is great, but it is completely inadequate for the needs of the UK. It is great for the kids that go to those schools; they will have a wonderful time learning about computer science, which is a tremendously exciting and creative subject. I would argue that every single school in the country needs to be offering computer science as an option at GCSE level. For the UK, we need to be better than other countries in terms of our education. It is not good enough for the status quo to carry on.

Q154 Jim Dowd: Is that the history of development in the technologically advanced countries? Some of them, even in the far east, a generation ago had nowhere near the technological might that they have now. Is that the path that they followed-increased education, increased innovation, increased production and increased technology?

Dr Mitchell: The number of engineering, computer science and IT graduates coming out of India and China has grown exponentially. However, one of the issues in India, for example, is the quality of engineering graduates. There is some evidence to suggest that an awful lot of the engineering and computer science graduates in India are "unemployable". At the same time, if even a quarter of them are highly employable, that number is still larger than the entire output of the UK in terms of engineering graduates.

Dr Harrison: I shall add some detail to that. Our international competitors have done two things. In the Pacific Rim, they have got the basics right. They have primary education right for all their students. They have high expectations of all their students, and they have moved into getting secondary education right. They are getting schools right with the basics. Then they started to create their contribution to a world-class university system.

We have so much that is already right in the UK. We are in a slightly different position. We have a world-class university system, and we are dealing with getting the basics right in schools. Our problem is more one of progression, because nine out of 10 kids give up science at the age of 16. Nine out of 10: that is shocking. When you look at the patterns across the country, they are uneven, and in some places the percentage is even higher. Our problem is not so much about the basics or about higher education; it is about getting a higher proportion of our 16 to 19-year-olds to stay with science, technology, engineering and maths. That is why having an inspiring computing curriculum from 14 to 16, with qualifications that match, is really important. That is why having engineering qualifications-and creative subjects such as design and technology, and art and design-alongside maths, science and English is important. It encourages our young people to stick with subjects and combinations of subjects that give them access to the best wages.

Nigel Fine: May I add to that? All that is good, but one problem that we have not really touched upon is our woeful inability to give career advice to young people. Career advice is not good in this country. Parents are not giving good advice. One in three parents do not know about engineering or engineering careers. Teachers are supposed to have a bit more insight, but one in five teachers in the STEM area may advise against engineering because they do not understand engineering or what it does. It is a big issue to take all the good stuff that we do, and all the evidence about what engineers and engineering do to help this country, and put it in a better way as career advice to teachers, parents and learners. That is what we are missing, and we need to do more of it in this country.

Jim Dowd: I think you'll find that a lack of understanding and an appreciation of what engineering does is not limited to the teaching profession.

Chair: We have a lot to do in about one minute. Roger.

Q155 Roger Williams: I have a question on the perennial concern about diversity in engineering. Perhaps, Dr Harrison, you can tell us how much funding the Academy has received from BIS since the spending review in 2010. Was it new money, or was it a continuation? Will you make a very quick assessment of what it has delivered?

Dr Harrison: As part of our grant settlement with BIS, we have a Diversity in Engineering programme that is funded to the order of about £250,000 per year over the four-year spending review period. It funds a job-share post to work across the institutions, and it is funding some pilot activities in individual institutions to look at particular issues-for example, the rate at which engineers, female engineers for instance, progress from being members of an institution to being chartered registrants and then to being fellows of the institution. Another example is a coalition of engineering institutions looking at creating an apprenticeship programme that has diversity as part of its construction-a programme built to be more attractive to a wider range of people.

Q156 Caroline Dinenage: Dr Harrison, in your submission you stated that the proportion of engineering apprenticeship starts has been dropping since 2007. Could you provide any figures on that?

Dr Harrison: It is a mixed picture. We see rapid growth in apprenticeships as a whole, but with different rates of growth among young people, 19-year-olds and the over-25s. I do not have time to find the figures, but from memory over the last two years we have seen growth in the order of 30% in engineering apprenticeships, whereas apprenticeships as a whole have had growth of about 60%. So there is growth, but there is a dilution of the proportion of apprenticeships that are in engineering, and in STEM more widely. Why this matters is complex, but one of the reasons is this. When we look at the outcomes from apprenticeships, they are fantastic in terms of wages. The return to the individual and the return to the employer is fantastic. That is based on historical data, when engineering apprenticeships were a very large proportion of the total. Now we have apprenticeships right across the board, which is welcome, but they are also in much lower-wage occupations, so as we go forward, the premium that young people, particularly, get from apprenticeships will of course drop, because a smaller proportion of them are doing apprenticeships in high-wage occupations. That is important, because we need to preserve the real value in the word "apprenticeship"-Apprenticeship with a capital A. It describes high-level-predominantly level 3-long-duration programmes that include both general education, advancing people's English and maths, and also more occupationally specific stuff.

Q157 Caroline Dinenage: Could this be explained simply because the level of apprenticeships in other subjects has gone up as a result of the wider popularity of apprenticeships, or is there another reason? Does the number of engineering apprenticeships look lower than other apprenticeships just because there has been such a huge growth in other areas? I did a morning apprenticeship with Costa Coffee; there has been a growth in apprenticeships in such areas, where presumably there were not many before. Is that the reason, or are there others?

Dr Harrison: Of course that is one of the reasons. But the reason why we might be concerned is that some of that growth has been in relatively short duration and relatively low-level apprenticeships, and the outcomes of those are so different from the outcomes of three and a half year level 3 engineering apprenticeships. We are not measuring like with like. I am encouraged by the growth in engineering apprenticeships, and particularly by the growth of advanced and higher-level apprenticeships, but we have to preserve the value in the apprenticeship brand, which is about long duration high-level programmes that absolutely underpin the productivity of the firm that employs them.

Q158 Caroline Dinenage: To your mind, is there any other reason why the number of engineering apprenticeships has fallen?

Dr Harrison: It has not fallen-

Q159 Caroline Dinenage: Or has not grown as much.

Nigel Fine: You have to look at the market in two ways. The large organisations, such as BAE Systems and Rolls-Royce, are over-subscribed by young people wanting to do their apprenticeships. In fact, statistics say that is harder to get an apprenticeship with some of those organisations than it is to get into Oxbridge. However, we have a big SME market in this country, and SMEs are finding it a bit more difficult to fund and support apprentices. They need apprentices, and we need to find ways of helping them to recruit and train apprentices in a way that is complementary to what happens with the large organisations, which are set up to do this. The other thing to say about apprentices is that the professional engineering institutions are really supportive of apprenticeship. We see it as a route to becoming a professional technician, and that in itself is a route to continuing on to becoming a professional engineer. We should look at this as a process of development of individuals through their learning; it does not necessarily stop at their being technicians. In terms of improving social mobility, technicians going through to professional engineering is a wonderful way to describe how young people with more of a vocation towards practical capability can actually progress into the professions.

Chair: That is a very powerful message on which to end this session. There is lots more that we would like to ask you, but there is not sufficient time. If there are other pieces of information that you would like to feed in, particularly on that last theme, we would be interested to hear from you. Thank you very much indeed for your attendance this morning.

Examination of Witness

Witness: **Carole Willis**, Chief Scientific Adviser, Department for Education, gave evidence.

Q160 Chair: Good morning. Thank you for coming to see us formally. We have had an informal discussion, but just for the record I would be grateful if you would introduce yourself.

Carole Willis: Thank you. My name is Carole Willis. I am the director of research and analysis and the Chief Scientific Adviser at the Department for Education.

Q161 Graham Stringer: Can you tell us how you ensure that the Department for Education policies are evidence based?

Carole Willis: I can. There are three key aspects to my role, which are fundamentally all about ensuring that the right robust evidence is being fed in to inform Ministers' policy decisions. I do that by ensuring that evidence is generated from within the Department, and analysis is undertaken. We have a very large set of admin data around attainment, which we feed in and analyse, looking at the potential impacts of different policies. I ensure that information is brought in from outside the Department, both in the form of external research that is commissioned by others, and from our own research programme, which commissions

different pieces of work on different policy questions. I also ensure that we bring in a range of different external experts to help and advise on particular issues. That is the external role of gathering the evidence and feeding it through to Ministers. I am also responsible for 200 professional analysts within the Department, who work across all the policy and delivery issues within the Department, helping to ensure that policy is driven by and informed by the best available robust evidence. Finally, personally I have a direct role in advising Ministers and advising senior policy officials around the evidence base and issues around different policy questions.

Q162 Graham Stringer: You are familiar with our predecessor Committee's report, *Early Literacy Interventions*, in which we criticised the methodology of the Department for not using randomised control trials. Our position was supported in the scientific literature. Have you changed your attitude towards randomised control trials since then? The view of this Committee was that you were not taking the best available evidence in order to determine policy, and that you rolled out Every Child a Reader before doing the proper investigation?

Carole Willis: If I recall rightly, my response at the time was that we could get a long way with carefully matched comparison groups in order to analyse some of these issues. We are looking very carefully at randomised control trials, and I have been discussing this with the Secretary of State, who has been very interested in some of the work that the Cabinet Office has been doing with Ben Goldacre around randomised control trials. They have just produced a paper called *Test, Learn, Adapt*, which tries to dispel some of the myths around randomised control trials. The Secretary of State has seen it, is very interested in it, and has been challenging us on whether we should be doing more RCTs. We are going to build a process into the research approvals process that I chair, to look in all cases, for all of our research, every time a question comes up as to whether we could adopt a randomised control trial approach. I would say that things are very much shifting in that direction, and that there is a real appetite for looking more carefully at the most robust ways of analysing the evidence.

Q163 Graham Stringer: What are the myths surrounding randomised control trials?

Carole Willis: I would need to double-check that leaflet and send it back through to you-but there are concerns about it being too costly, too time-consuming.

Q164 Graham Stringer: With respect, those are not myths, are they? They are the normal currency of everyday decisions in Government: "This is expensive; we can't afford it," or, "This takes a long time. We'd like to know the answer." That was the whole problem of the original report, was it not, that you wanted to roll out Every Child a Reader without getting a proper evidence base?

Carole Willis: I really need to refresh my memory on all of that evidence, but the concern there, as in a number of such situations, is about implementing something that is seen to be useful to a range of different schools, and everybody wanting to do it. There is something about trying to help schools to understand that it is really important that we test out these things properly, so that we can get their buy-in to identifying a control group of schools that are willing to take part in that type of research. That is one of the big challenges.

Q165 Graham Stringer: You have partly answered the next point that I was going to ask about. If you are not going to use randomised control trials, how do you gather evidence and

check the effectiveness of policies? It seems to me that what you are saying is that rather than gather the evidence we are rather keen on jumping the gun, for political reasons.

Carole Willis: I don't think that that is what I said at all.

Q166 Graham Stringer: That is my interpretation. What you are saying is, "We want to roll them all out together." I am not saying that you are taking the political decision, but you are advising Ministers who do have political pressures on them.

Carole Willis: My raison d'être, my key rationale, is to ensure that the range of different evidence is presented to Ministers to inform policy decisions, and to try to set out clearly the relative robustness of different types of evidence. I see it as a very broad spectrum. At one end you have RCTs and at the other you have stakeholder views, and you have everything between. Trying to pull together the range of that information, whether it is administrative data, carefully constructed research activity or information from outside the Department, and presenting all of that and feeding it into the policy decision, is absolutely crucial. It is what I spend my whole day trying to achieve.

Q167 Chair: What was the range of data that you presented to Ministers, apart from the Wolf report, that resulted in the downgrading of the Engineering Diploma?

Carole Willis: Alison Wolf pulled together a lot of information, and that is the key basis for all the reforms to the performance tables. That included a lot of academic evidence, so there is 15 or 20 years work looking at the labour market returns for different kinds of qualifications-people like Anna Vignoles, Lorraine Dearden and Steve McIntosh.

Q168 Chair: That is one source. What about the Royal Academy, IET or BCS, which have just been before us? They have wildly different views. So you gave one source to the Minister?

Carole Willis: No, absolutely not. Alison Wolf looked at the full range of evidence.

She had over 400 responses to her inquiry. She also looked very carefully at the international evidence. On an ongoing basis, the Department is actively involved in working with a whole range of external organisations. I am an economist by background, not a hard scientist, so it is even more important that we draw on the expertise of organisations such as the Royal Academy, the Institute of Physics and the Royal Society of Chemistry. There is active engagement with those organisations on an ongoing basis.

Q169 Chair: This "evidence-based policy" that we are talking about does not square up to all the evidence that we have received that condemns the decision to downgrade the diploma. How can that be squared with what you have explained to us?

Carole Willis: The Wolf review highlighted the fact that there are a number of vocational qualifications that young people have been taking, which have no value in the labour market and in some cases negatively harm their prospects compared to not having done that qualification at all. The reforms to the performance tables are aimed at identifying the most robust set of vocational qualifications that young people can take to give them the best possible opportunities going forward in the labour market.

Q170 Graham Stringer: We hear a lot of statistics on this Committee, but I was a bit surprised by the fact that you have 200 analysts looking at these figures. Is it absolutely necessary to have 200 analysts? Can you tell me how large the current research budget is, and whether it is going to stay the same in cash terms, diminish or increase over the next financial period?

Carole Willis: Two hundred professional analysts is by no means the top of the table across different Government Departments. There are lots of other Departments-

Q171 Graham Stringer: This is an even bigger problem than I thought it was, then.

Carole Willis: Personally, I would like to see more, but we live in financially constrained times. As important as the number of analysts is how they are used. The Committee will have seen the publication last week of the DFE review that the permanent secretary commissioned, and alongside that we have been doing a thorough review of analysis, research and data within the Department and thinking about how that can be used most effectively in policy development, how we can get analysts working really closely right from the outset on a consistent basis on all of the different policy issues, and how we can ensure that the right evidence and data is more easily accessible to the full range of people within the Department. In terms of your question about the research budget, my research budget is £9.5 million this year. We are just about to go into the next business planning round, where I will be looking very carefully, including consulting external academics, at what the evidence gaps are within the Department that we need to address over the next year or so, and I will be presenting advice to Ministers about what we should be doing, what we should be spending money on, and therefore how much we should be spending on research going forward.

Q172 Graham Stringer: Do you expect it to increase or decrease?

Carole Willis: I have not done the work yet. It is a demand-driven approach, including demand from me, so there is no "right amount" of research. We need to look carefully at the evidence gaps, and what needs to be undertaken to fill those.

Q173 Chair: I asked you about the ubiquitous condemnation of the downgrading of the Engineering Diploma. Your response was about vocational qualifications more broadly. Now can you give us the answer: where was the evidence that said that the Engineering Diploma, per se, should be downgraded? Was it based upon a proper risk assessment? Did you look at the way in which students and parents would be disincentivised?

What was the evidence on which the decision was made?

Carole Willis: It is worth reminding the Committee that the Principal Learning qualification, within which the core part of the Engineering Diploma lies, still appears on the list of 140 vocational qualifications that will count in the performance tables going forward, alongside a number of other engineering qualifications, and indeed a wider set of STEM qualifications. It is still there; it is being offered by awarding organisations and it is seen as a high-quality course of study. All those qualifications were worth varying amounts in terms of their previous equivalents. They are all now treated as one GCSE, but the criteria that we used to identify that list were consulted on. They were an attempt to identify that range of the highest-quality qualifications. They included the criterion of it being at least the size of a GCSE. Part of that is about the concern that schools were offering those kinds of

qualifications to people simply in order to push their way up the league table rather than thinking about what was in the best interests of their students.

Q174 Chair: Does the fact that there seems to be a reworking of the diploma suggest that a mistake was made in the first place?

Carole Willis: I am really pleased that the Royal Academy of Engineering has developed work with awarding bodies and engineering employers to develop those four qualifications. Potentially, that could even mean a greater range of choice for individuals, and might mean an even greater take-up of engineering. Just to finish on the point about the evidence, there was a full impact assessment conducted and published around the impact of the reforms to the performance tables.

Q175 Stephen Mosley: I want to move on to university technical colleges. It is quite an open question to begin with. What evidence do you, as a Department, collate on the effectiveness of UTCs?

Carole Willis: There are only five open at the moment, as you will be aware, and we do not have any results from them yet. We will have results from the two that opened in September 2011 when we have developed performance tables at Christmas, or finalised them. I shall be looking very carefully at the attainment within those different institutions. What we collect is quite a lot of information on background pupil characteristics, through the school census. I shall be looking to undertake analysis, controlling for the background characteristics of the pupils entering those kinds of institution, and comparing them with similar attainment levels in other sorts of institution to see whether, and the extent to which, those organisations are adding value.

Q176 Stephen Mosley: If you have not been able to collect the evidence on performance so far, and you plan to open another 34, I think, over the next three or four years, what evidence are you using to decide that 34 is the right number?

Carole Willis: There are a couple of things. The university technical colleges partly grew out of the city technology colleges, which have been open for a longer period, and some of the promising results in those organisations. But, as I am sure the Committee is aware, the core rationale behind those UTCs is to have active engagement from employers and universities to help ensure that the programmes of study that are being completed can enable young people to have the best possible chance of going on to HE and some form of employment. There is that particularly valuable aspect, and that degree of engagement with such organisations.

Q177 Stephen Mosley: What is the main driving force behind this? Is it the employers coming to you and saying, "We want to have a UTC," or is it yourselves looking at a map and saying, "Oh, that looks like a good area." How do you decide where you are going to have one?

Carole Willis: There is a thorough assessment of business cases. It is about university departments coming to us and saying that they want to set up one of these organisations. The proposal is then thoroughly assessed, to explore things such as whether or not there is justifiable additional demand for that kind of organisation in that particular area, and what the educational benefits are going to be.

Q178 Stephen Mosley: Lastly, from what you have seen with the opening of the five so far, have there been any surprising results? Is there anything that you have learned from it?

Carole Willis: It is too early to tell. In a month or so, as I say, we will have the final performance results broken down by institution. We will be able to look at them for a range of different institutions.

Q179 Stephen Mosley: In terms of looking forward, I know that you cannot tell at the moment, but if something came out next month how would that then feed into the process for setting up new colleges?

Carole Willis: I would ensure that the policy team working on those issues were aware of it. If there were any surprises, we would want to look very carefully at what was happening.

Q180 Caroline Dinenage: Can you confirm how many pupils have been entered for the E-bac in total?

Carole Willis: Yes, I have some figures here. The total number of pupils who were entered for the E-bac, including those in independent schools, was 155,000 in 2011-12. In state-funded schools, there were 129,000. That is 25% of students overall entering the E-bac, and 23% in state funded schools.

Q181 Caroline Dinenage: Thank you. The overwhelming evidence that we are getting from our witnesses points to a concern that the introduction of the E-bac is in some way going to limit the number of people that go on to study computer science, design and technology and ICT at A-level and beyond. What evidence do you have to disprove that?

Carole Willis: The E-bac is only supposed to cover part of the curriculum. It leaves about 30% of 40% of time in the curriculum for studying other things. The rationale for setting up the E-bac was partly around international evidence that other high-performing jurisdictions were asking their students to study a similar range of core academic subjects up to the age of 16, before they went on to specialise in other things, and the fact that the progression rates for the E-bac subjects were particularly high. I know that there are lots of other vocational routes to HE and to other engineering occupations, but to the extent that the acquisition of maths and physics A-levels are important, the E-bac students are much more likely to go on to study science A-levels than pupils getting five good GCSEs including English and maths, for example. As a route into engineering, it is quite powerful.

In terms of how it is impacting on other subjects, we have commissioned two independent pieces of research to monitor and try to understand how schools are responding to the introduction of the E-bac. There have been some responses, and some have changed their timetabling options and their curriculum offer. We are expecting to see quite a big increase in the number taking triple science and double science. At the moment, about 64% of pupils take double or triple science, and we are expect that in 2014 to be closer to 80%. It is had some incentive effect. As a consequence of that, some schools are stopping offering other sorts of qualifications, but the intention was never that all pupils would take this. As I say, only 23% are taking it this year, and we would hope to see some further increase going forward. About 49% of students are currently studying E-bac subjects that they will take in 2014, so half the schools are still offering a range of different subjects. It is a signalling device, and it sits alongside a whole range of other measures in the performance tables, and it

is really important that schools are thinking carefully about what is in the best interests of their students.

One of the young people who came to see you in a previous evidence session was really exciting about the design and technology that she had done. That kind of thing is still open for schools to offer. We would expect them to want to try to engage young people in the best way possible, to help maximise their chance of success.

Q182 Chair: But have you not sent the message to schools that that is not core? You might have heard the evidence from some of the engineering institutions that they firmly believe that learning about the application of some of the academic disciplines is very relevant to their needs. Putting design and technology outside the E-bac-hasn't that sent the wrong message to schools?

Carole Willis: As I said, the E-bac is only part of the curriculum, and it has been designed with the evidence from other countries about the kind of things that they are offering that give students the maximum number of chances and options in terms of what they do post-16, and the kind of vocational qualifications they might then choose to concentrate on afterwards-but it does not rule out being able to undertake that range of other things. The Department probably has a very long list of people who all have their own ideas about what should be in the E-bac.

Q183 Caroline Dinenage: I have a final question. Given that the E-bac was only introduced in 2010-

Carole Willis: 2011.

Caroline Dinenage: -in 2011, and that it will be replacing the GCSE system in 2017, are you satisfied that there is sufficient evidence that it is going to make improvements to education?

Carole Willis: Are you referring to the English baccalaureate certificate qualifications?

Caroline Dinenage: Yes.

Carole Willis: There are two separate things. The English baccalaureate is a signalling device. It says to schools, "This is an important set of subjects." The English baccalaureate certificates are a new set of qualifications designed be more rigorous than the current set of GCSEs in a particular set of subjects. As you will know, there is a consultation under way at the moment looking at those. I am satisfied that there is evidence to suggest that the GCSE system as it currently stands is not working as well as it should in terms of giving students high-quality qualifications that stand them in good stead in the labour market.

Q184 Roger Williams: Turning to work experience, perhaps you could tell us why the requirement for pupils at key stage 4 to do a set amount of work experience has been removed.

Carole Willis: I can certainly tell you about the evidence that led to that decision. Again, it was tied up with Alison Wolf's report, and her extensive review of the evidence, which, she concluded, suggested that work experience is really important. It is a very valuable way for young people to attain the kind of skills that employers need in the labour market, and it is

one of the reasons why apprenticeships have a relatively high rate of return in the labour market. The rationale for her recommendation that that duty be removed from key stage 4 is that it was better undertaken at key stage 5. The study programmes that the Department is working on at the moment expect all young people, unless they are doing an apprenticeship that has that core employment component in it already, will be undertaking some form of work experience, and we shall be piloting that; indeed, we are in the process of trialling the best way to do that with an independent evaluation.

Q185 Roger Williams: Could you tell us whether any other evidence, apart from the Wolf report, was taken into account?

Carole Willis: The Wolf report was very broad in terms of the range of different views that fed into it. The other issue under consideration was around minimising bureaucracy in schools. We have a lot of evidence of schools complaining about all the things that they are required to do, and the bureaucracy involved.

Q186 Roger Williams: There is some suggestion that schools that still believe that work experience is important might not be quite so competitive in academic results, because of that. Obviously, taking two weeks out of a term might have that effect. Would you like to comment on that?

Carole Willis: I am not aware of evidence supporting that. Schools are still free to offer that work-related learning, where they think that it is in the best interests of their pupils. Re-examining all of this, there seem to be two sets of things. One is about the value of work experience and the extent to which it can offer those employability skills-and I think it is right that that is at key stage 5. The other aspect where can it can be helpful is helping young people to understand the world of work and to make some career decisions-but there are different ways in which that can be achieved. There is something about information, particularly in the context of engineering and inspiring young people, and there is a range of different ways in which that can be done. Having somebody coming into the school and talking about their experiences, and what it means to be an engineer, can be incredibly powerful for young people, rather than necessarily going out on work experience. I did maths and physics at A-level quite a few years ago, but nobody even mentioned engineering to me at the time, and I had no concept of what that might involve, but if somebody had come in to the school and inspired me, telling me what it was about-

Q187 Roger Williams: Perhaps it would have been valuable if I had been able to put a question to you about diversity in engineering earlier. Does the Department intend to gather evidence about the effect that lack of work experience may have on children at key stage 4?

Carole Willis: The main way in which that would be monitored is in terms of the progression rates for young people. We have just introduced-this year-a new set of destination measures, so we will be looking at those quite carefully. Those are broken down by institution, and they look at what routes young people go on to once they have left that particular institution. That is one of the other incentive mechanisms that sit alongside the E-bac. Schools still have a whole set of incentives to offer the range of subjects that their children can succeed in, and which will put them in the best possible position for their further progression.

Q188 Chair: I think that we have covered all the ground that we wanted to cover. Again, in the light of the reference to some of the statistics, if there is any further data that you feel

ought to be placed before us before we start drawing up our conclusions, we would be extremely grateful. Thank you very much.

Carole Willis: May I make one further point, about girls and physics? From looking back at all this evidence, that is one of the key issues that we need to tackle. At GCSE, very similar numbers of boys and girls are taking GCSE physics; there is a slight difference in the numbers. At A-level, the number of girls going into physics drops dramatically. In terms of that academic route through into HE, and the importance of maths and physics at A-level, there is a big issue. We have been working with the Institute of Physics, with the Stimulating Physics Network, to try to address that, and we have seen the numbers of boys and girls taking GCSE and A-level physics go up, but we are still not narrowing that gender gap, and that is one of the key areas that we will need to focus on going forward.

Chair: Thank you very much indeed.

Examination of Witnesses

Witnesses: **Elizabeth Truss MP**, Parliamentary Under-Secretary of State (Education and Childcare), Department for Education, and **Matthew Hancock MP**, Parliamentary Under-Secretary of State (Skills), Department for Education and Department for Business, Innovation and Skills, gave evidence.

Q189 Chair: Good morning, Ministers, and welcome. You are aware of the background to this inquiry. Would you first explain to us how your particular ministerial responsibilities overlap with the objectives of this inquiry?

Elizabeth Truss: My ministerial responsibilities are for the curriculum and qualifications to 16-key stage 2 tests, GCSEs and the development of the EBCs. I also have responsibility for A-levels.

Matthew Hancock: My responsibility is for all learning over the age of 16 outside universities; while Liz takes the lead on A-levels, I am responsible for vocational qualifications.

Elizabeth Truss: And funding.

Matthew Hancock: Everything above the age of 16 other than A-level curriculum design and universities.

Q190 Chair: How do you split your time, Mr Hancock, between the two Departments?

Matthew Hancock: I try to make sure that the people who we serve have a seamless service across both Departments. I am a realist about Whitehall, and it is a day-to-day job to try to bring the two Departments together. I do not specify an amount of time in each Department. I regard myself as the Minister for Skills in both Departments all of the time, no matter where I am sitting. I have a physical office in each Department, but I have one private office that, for instance, reports to me wherever I happen to be. The funding for the provision for which I am responsible comes at around two thirds from the Education budget and one third from the BIS budget. One of my goals is to make sure that the bodies that receive the funding get it in a

way that is consistent between Departments rather than having a barrier. I know that that was not a precise answer to the question, but that is because I do not have an answer. I do not record the amount of time that I spend physically in each Department. I am the Minister for Skills wherever I am.

Q191 Chair: Can you tell us how improving engineering skills, in particular, within the UK fits into the Government's growth agenda?

Matthew Hancock: It is critical. Within the industrial strategy that the Secretary of State for Business, Innovation and Skills set out in September, and which we are populating and driving through in different sectors and in collaboration with those sectors, it is very clear that there is the potential for a shortfall in engineering skills over the years to come. Although the number of apprenticeships in engineering is rising, for instance, and the proportion of students taking STEM subjects at university is rising for the first time in a while, it is an area where we know that we need to do more. It is very important. It is important in vocational qualifications, but it is also important that the students who want or might want to go on to do engineering have a rigorous grounding in the basics.

Q192 Chair: Before we move on, do you see vocational qualifications as something different from academic qualifications?

Matthew Hancock: They are inherently different. I see them as equal in value.

Q193 Chair: Do you not see a continuum between the two?

Matthew Hancock: There is something of a continuum, but clearly there are qualifications that are more vocational. Within the vocational category, I would also break it down into those that are general applied qualifications, such as some BTECs in science for instance, and those that are occupational and specifically targeted at success in an individual occupation. Of course, there is a spectrum.

Q194 Caroline Dinenage: I want to talk about the English baccalaureate. In a lot of the evidence that we have gathered, our witnesses have expressed concern that the introduction of the E-bac will underplay the amount of emphasis on things such as computer science, design technology and ICT. In one of our evidence sessions, the National Grid said that the English baccalaureate seemed at best to be irrelevant to improving the UK's engineering skills, and that at worst it might exacerbate negative perceptions of engineering careers. I ask first for your thoughts on that, and secondly how you will ensure that the E-bac does encourage schools to concentrate on these subjects that are going to help deliver a future generation of engineers.

Elizabeth Truss: First, I do not think that that is true about the English baccalaureate. What we have seen since we introduced it is that the number of students studying single sciences has gone up, and obviously physics and maths are key underpinning subjects for engineering, so what the English baccalaureate does is highlight the importance of rigorous science subjects. That is positive. The number of pupils taking GCSE triple science has gone up from 48,000 in 2007 to 152,000 in 2012, so we have seen a strong increase in the number of students taking science subjects, which is an important background to engineering.

On the subject of ICT, the Secretary of State has been very clear that we want to see changes in the curriculum, so that students are learning about coding and developing computer programs, and understanding how computers work rather than just using computer packages, which was the previous approach for ICT. We have been very clear that we want to see that developed at primary as well as secondary schools, so that developing technology is very much part of what all students are doing. We are shortly due to release the draft programmes of study for both primary and secondary education, and we will be outlining our plans in more detail then.

Matthew Hancock: Obviously, I would agree. Having a rigorous core is the foundation of success in careers across the piece. Of course, it is possible to combine the EBC with specific engineering qualifications, and we may come on to the testimony by Dr Harrison and the work that we are doing there, specifically on rigorous engineering qualifications. You've got to have a rigorous core. For instance, yesterday we announced that we are doubling the funding in FE and within apprenticeships for English and maths for those who do not have level 2. These sorts of changes in this direction are critical for providing the base off which our future engineers can spring.

Q195 Caroline Dinenage: How do you address the fears of a lot of employers that by not including engineering types of subject, like design and technology and ICT, within E-bac subjects, you might somehow be very much encouraging some schools to focus on those core E-bac subjects to the detriment of other things?

Matthew Hancock: We are clear in the accountability systems that have been put in place-they were revised yesterday-that alongside a rigorous core the value of such qualifications and the ones in development are held in the same esteem. The system is designed specifically to make sure that high-quality and stretching qualifications in engineering are recognised. The critical point is this. They have to be high quality and stretching. There is no point in recognising poor-quality vocational or engineering qualifications and then trying to argue that they ought to be held on a par. The route to having vocational qualifications across the piece, including engineering qualifications, held in the same esteem as core subjects such as English, maths and the three sciences, is to make sure that they are high quality and stretching. That is what we are trying to do.

Elizabeth Truss: It is very important to employers to see students who understand the underlying principles of what they are doing, who get the basics. So much of the work that we are doing in revising the curriculum for primary education is making sure that students have a good knowledge of multiplication, ratios, logical structures, arithmetic. All those things underlie structures that will be developed to learn things such as computer programming. Coding and computer programming derive from mathematics and, likewise, advanced physics needs a strong basis of mathematics underneath. It is important that students have that ability, that fluency in mathematics. Then they can go on to do things such as programming a computer or develop their work in physics. Yes, those things are important, particularly later in a school career, but we need to get the basics right. Too many students are leaving school without the basics. If you look at the UK's performance in the PISA tests, we are 28th for mathematics and we have the smallest proportion of students studying maths from 16 to 18. Until we get the underlying structure, and the language that engineers and computers programmers use, we are not going to be able to achieve those higher-level skills. It is very important to get the focus right and to make sure that students

are fluent in those things. Then, absolutely, these are the careers of the future, which we should be encouraging more people to go into.

Q196 Caroline Dinenage: Finally, with regard to the introduction of the EBC qualifications, are you confident that enough evidence has already been gathered, and is continuing to be gathered, to back up the decision to replace GCSEs in 2017?

Elizabeth Truss: Yes. There were various issues with GCSEs, and I have been working on the development of the curriculum-and, together with Ofqual, on the development of the EBC criteria. We have been meeting experts in areas like physics and mathematics, and other organisations, to develop programmes of study, to make sure that they will prepare students for what we need them to know now, and what we need them to be able to do now. We will shortly be releasing those curricula. It is very important that we are enabling students, as well as to process the information correctly, to think about these subjects. That is one of the things that we are focusing on in the development of the EBC. We are actually testing students on their ability to solve problems and think, which is critical to the kind of skills that you need in engineering.

We are undertaking a wide range of reforms to the primary school curriculum, to make sure that students are fluent, particularly in mathematics and the basics. When they reach secondary school, we are raising the level of our curriculum to compete with the best curricula in the high-performing jurisdictions, and we are looking at leading examples across the world, at countries that have been very successful and countries that have transformed their systems-countries such as Germany and Poland, that have succeeded in improving their results in the PISA league tables. We are looking at all that international evidence.

Another key focus is on improving the participation of students in maths from 16 to 18. Currently, we have the smallest proportion of students studying maths from 16 to 18 in the OECD. That has a massive knock-on effect for engineering. UCAS has certainly given evidence, and ACME has suggested that, in terms of the number of students having maths for appropriate university courses, we are approximately 200,000 students short. We are trying to develop mid-level qualifications. For students who may achieve a B or a C grade at GCSE, who do not necessarily want to go on and do A-level maths, there is an option that they can keep their mathematics going and learn new and appropriate skills. We have commissioned MEI and Professor Tim Gowers from the university of Cambridge to develop a mid-level qualification in mathematics, specifically with the idea of driving up participation. I have been talking to university groups such as Universities UK about how that might work in terms of the subjects that they are asking students to have. It is very important that we develop that level from 16 to 18, because it is a big missing part in our jigsaw, not just in terms of getting the right students in to study those subjects at university, but making sure that the next generation of primary school teachers have that extra level of mathematics that they can then feed into their teaching, improving the system overall.

Q197 Chair: I am very tempted to ask whether you could answer the questions that Tim Gowers set in *The Sunday Times* three weeks ago, but that would be very unfair.

Matthew Hancock: She has already done it.

Elizabeth Truss: I have to praise Matt here. I asked him one of the questions-Tim Gower's question about the airport travelator-and Matt was able to answer it straight off. He passed the test with flying colours.

Q198 Graham Stringer: Do you accept that it was a mistake to downgrade the Engineering Diploma in 2010?

Matthew Hancock: I would not describe it as being downgraded. The system was brought in with the overall goal of ensuring that valuable and high-quality vocational qualifications were recognised as such. One of the rules within that system to make it work was that each qualification could count for no more in terms of equivalence than one GCSE. I know that a strong argument was made that the Principal Learning component and the Engineering Diploma should count for more. When I arrived in this job in early September, one of the first things that I did was to get on the phone to the Royal Academy of Engineering and talk about bringing in what look likely to be four separate qualifications that both fit within the accountability structure and are rigorous and employer led. They will be within the structures as designed, and also do the job of providing engineering qualifications that employers like, and which are rigorous and of high quality.

Q199 Graham Stringer: I am surprised that you do not accept that it was a mistake. It certainly sent out a signal to schools that if they wanted to be higher in the league tables, this was not something that they should be teaching. We heard from the Royal Academy this morning that there has been a flight from engineering courses over that period, and it took George Osborne to announce earlier this month that there would be a reworking of an engineering scheme by the Royal Academy. I do not know what your definition of a mistake is, but if you had a system that was attracting more students, you changed the system so that students were not doing that subject, and then asked for a reworking of it so that you could attract more students, that seems very much like a mistake to me.

Matthew Hancock: I would say that, for the double GCSE in engineering, numbers went up. If you look at the total number of those studying engineering at 14 to 16, there was not the broad decline that you described.

Q200 Graham Stringer: There was a decline in people doing the Engineering Diploma.

Matthew Hancock: My point is that there was not a broad decline in the number of people doing engineering at 14 to 16. Crucially, the accountability structures were brought in for a good reason. It was to make sure that vocational qualifications that are stretching and of high quality are recognised appropriately, and that others that are not, are not recognised in the same way. As I said, one of the things that I have been doing over the past couple of months has been working with the RAE, which led to the announcement that you referred to. I think that that sends an extremely strong signal about both the value that we attach to engineering and the fact that we are going to make sure that we have qualifications that are rigorous and of high quality at the same time.

Q201 Graham Stringer: When do you expect the new diploma to be available?

Matthew Hancock: It won't be a diploma. It will be four separate qualifications. That, by the way, also increases the flexibility of being able to deliver it. I certainly hope that it is recognised in the list for this time next year. Yesterday, we published the list of recognised

14-to-16 vocational qualifications for the second year running. I certainly hope that they will be in next year, subject to Ofqual signing off the qualifications course.

Q202 Graham Stringer: When you say next year, do you mean the academic year 2013-14?

Matthew Hancock: I hope that the sign-off will be in November 2013, to be taught from the following year.

Q203 Graham Stringer: You don't think it a mistake, but what message do you think has been sent out by those changes in the importance of engineering and vocational education?

Matthew Hancock: I think that the message that we are developing, with the RAE, a high-quality set of qualifications-within the accountability structures that ensure that vocational qualifications are rightly regarded as high-quality, because we recognise the ones that are stretching and high-quality-is a positive message. Certainly, the feedback that I have had since we launched these qualifications has been extremely positive.

Q204 Stephen Mosley: I want to move on to university technical colleges. We now have five open. Three opened in September this year, and two were opened previously. We had Carole Willis speaking to us earlier, and she said that you have not yet been able to do a full assessment of how effective those UTCs are. If you have not been able to do that assessment, how are you learning the lessons for the proposal to open another-is it 24 by 2014 and 34 in total?

Matthew Hancock: There was a goal set out for 24, but there are now 28 in the pipeline in addition to the five that are already open. Of course, it is early days. The evidence from the JCB UTC is very strong. In engineering, it got an extremely high pass mark-unsurpassable, you might say. Also, the news on the engagement with employers and the destinations of its students is terrific. There were several students who had turned down university places in order to take higher-level apprenticeships with JCB and others. In terms of raising the lustre and getting kids into engineering and STEM careers, the first one has been a great success.

Q205 Chair: I went to the JCB academy. It was very impressive-an extraordinary place. We had the head teacher and a young witness here at our last session, and their responses on the Engineering Diploma were exactly opposite to what you have just said to Mr Stringer.

Matthew Hancock: When was that? Was that before or after the announcement?

Q206 Chair: It was about two weeks ago.

Matthew Hancock: Well, the new qualifications are being developed in order to fit into the new accountability structures. There are 28 UTCs in the pipeline. Of course we will keep measuring their success as they come along, but it takes quite a long time to get measures of success. You have to wait to get a full measure of success, because you have to wait for children to go through, but you have to look at all the indicators that you can. We are keeping a very close eye on them, but so far the feedback has been extremely positive.

Q207 Stephen Mosley: Jim Wade, the principal of the JCB academy, is obviously very supportive of UTCs. However, one concern that he did express was that there might be an

aiming for targets, in terms of how many of these things are to open, rather than focusing on the quality of them when you open them. Do you have any concerns about that?

Matthew Hancock: No, I do not. The proof of the pudding is in the eating, in that a target was set for 24 and the funding was put aside, but we now have 28 in the pipeline, as well as the five already open. It is because it has been a very successful policy that we have gone further than the number originally set out. That shows that there were more high-quality applications than we were expecting and that we had set as a target, so I am not worried at all about having to sign off on UTC applications because we have to hit a target. On the contrary, it already looks as if we are going to go over it.

Q208 Stephen Mosley: We had a head teacher from Newstead Wood school, a specialist science school. Her concern was that you are focusing a lot of effort on these UTCs-which is great-but she wanted to make sure that you did not forget about the vast mainstream of schools that are teaching engineering and sciences. Are you able to give any reassurance?

Matthew Hancock: Absolutely. We are not forgetting any schools. There is a reform programme across our schools, obviously in terms of new entrants such as UTCs and free schools, but also in terms of strengthening the governance of existing schools through the converter academy process, and then on the curriculum and on making sure that we intervene in schools appropriately when they are not succeeding. That means the tough Ofsted regime, and especially the toughening of what used to be called the "satisfactory" rating, which was anything but. So there is a whole range of things that we are doing, to focus both on getting more good school places and also on improving the places that we've already got.

Elizabeth Truss: On encouraging a diversity of provision, one of the other things we are doing is working on the idea of maths free schools, particularly for 16 to 18-year-olds. We have some free schools opening that are specialising in maths and science, such as the Sir Isaac Newton free school in Norwich, which is going to offer an education where all students are doing core maths and sciences. We are also working with universities on maths free schools, to make sure that more students have the opportunity to get up to that really high level in maths and science to get places at top universities. One of the other things, alongside the programme that we are developing for a new course for 16 to 18-year-olds, is that we also have Cambridge university working on developing the curriculum to deepen what we are doing for 16 to 8-year-olds and providing additional material. That is another way in which we are broadening out the curriculum, so that more students are getting that experience of high-level mathematics.

Q209 Jim Dowd: These questions are for you, Mr Hancock. They are about careers advice on engineering. Over the past few weeks, we have received a number of submissions on its perceived quality, and they range, at one end, from virtually non-existent, up to the high end of woefully inadequate. Indeed, barely 30 minutes ago your own chief scientific adviser said that engineering was never mentioned to her as a possible option when she was going through secondary education. What is your attitude towards the standard of careers advice on engineering generally?

Matthew Hancock: My attitude towards careers advice across the piece, which certainly applies to engineering, is that it should come from a multitude of different sources-it does anyway, of whatever quality-and it should be about inspiring and motivating young adults into what they might want to do, and making sure that they have good high-quality

information. That is a big task. Schools have the duty to provide independent and impartial advice. That is relatively new. The guidance is very clear that schools should be encouraging all sorts of advice. One of the best things that engineering companies can do, for instance, is to engage with schools, going in to advise and inspire young people into going into engineering and showing them what is available.

For instance, I was in Tipton academy yesterday. It was set up by the RSA, and it does the international baccalaureate. It also, unusually, does the international baccalaureate careers-related certificate, which combines two IB sections with vocational skills, and also employer engagement. There are kids on that programme who spend a serious amount of time going to local employers and local engineers in order to find out how the work that they are doing in school works on the ground in a real company, and being set real problems. The motivation that comes from that engagement between employers and schoolchildren, especially in a subject like engineering, which to a degree is hands on, where you can see the practical consequences of the work that you are doing, is really powerful.

Q210 Chair: Before you move on, may I ask whether you are going to design into the curriculum enough space and time for teachers to engage in continuous professional development? One of the problems is that many teachers, although they may be inspiring-they may have inspired you to do economics and philosophy respectively-perhaps do not have a full understanding of today's engineering.

Matthew Hancock: I quite agree. Some do; let us not tar everybody with the same brush.

Q211 Chair: It is not about tarring them. Let me be clear: I am not criticising teachers. I am criticising a system that does not provide sufficient space for continuous professional development.

Matthew Hancock: Of course teachers are one source of advice, but my argument is that the implementation of the duty to provide impartial and independent advice is about getting all sorts of people into schools, whether they are teachers or local employers-or, indeed, national employers. Our employers, and especially our engineers, can play a big part, and many of them already do. For instance, STEMNET's STEM ambassadors are going into schools and not only providing advice directly but being a source of logistical support. Going to schools is not part of a company's core purpose, and we should make it easier. That is something that the STEM network does, and it is a really positive step.

Elizabeth Truss: I want to follow up on your point about flexibility in the curriculum. The new curriculum that we are designing is less prescriptive, so it will give more room for teachers to have the flexibility in how they teach the subjects, to make sure that those subjects are as inspiring and motivational as possible, but will also give teachers the time for things such as professional development. That is part of what we are working on in terms of the design of the new curriculum.

I want to add another point. If you look at the curriculum structure in this country compared to countries such as Germany or Canada, in other countries there is generally a core specified for longer. Traditionally, we have had a relatively narrow core in terms of what we specify to 16, and what we specify to 18. That has meant that students have inadvertently closed the door to particular options fairly early in their school career in subjects such as physics and maths, in the 16-to-18 age group. One of the things that we are seeking to do through the

English baccalaureate, as well as reforms to 16-to-18 education, is to encourage students to keep their options open for longer, and to keep studying those subjects. It is often difficult to decide at the age of 14 what future job you want to have. We need to allow students space to think and time to develop what they are interested in and what they do. Too often in the past, students have closed the door early to subjects like physics, which then precludes them from taking engineering later in their school and university career.

Q212 Jim Dowd: I accept the point you make, Mr Hancock, that there are pinpricks of light out there-but the unanimous view that we have received is that there is an overwhelming gloom surrounding careers advice and promoting engineering. Do you think that that could be addressed by a more centralised approach, or are you happy to leave the matter to be locally ignored, as it is at the moment?

Matthew Hancock: We have a centralised duty. That is new, and it needs to be implemented properly. I would urge you to look at some of the evidence on the ground. The Gazelle group of FE colleges is an amalgamation of about 30 FE colleges that all get enterprise, entrepreneurs and local employers into college. They are extremely go-getting and positive about using the curriculum in order to get real-life work experience into what happens in college. The best FE colleges are brilliant at doing this. If you go to, say, the North Hertfordshire college in Stevenage, it works very closely with local employers. In fact, it has a learning company within the college, and the students can plug into that to start their own businesses off the backbone within the college, so it is easy to do it and it gives them space. It is a bit like a mini-Stanford. This is an FE college, and it is a really good example. I come across examples like that in my travels around academies, schools and FE colleges across the country. We need to make that much more widespread, and we need to use the new duty to advise to drive it through, but we should not see it as trying to provide a single point of advice to individuals. Far better is a multiplicity of advice, especially given by inspiring people who can really motivate, because they are doing it themselves.

I would also add that, of course, apprenticeships are crucial to this. The new destination data being published by schools and FE colleges will include, for the first time, the proportion of students going into apprenticeships, as well as to university. This is really important. We are putting the publication on a level playing field across institutions, between schools and FE colleges, to make sure that people can see-

Q213 Jim Dowd: This is as between degree courses and higher apprenticeships?

Matthew Hancock: Apprenticeships at whatever level and degree courses. Of course, apprenticeships are work experience and a job at the same time. That is the essence of them, and the evidence shows that in many case higher apprenticeships lead to a value added, over somebody's lifetime, even greater than the value added of going to university.

Q214 Jim Dowd: The sainted Mr Jim Wade of the JCB UCT said to us that he thought that there was a perverse incentive to keep young people on at sixth form so that they would do degree courses, rather than sending them to higher apprenticeships, because although they are of equivalent merit they are not regarded in that way in the calculation of school attainment and league tables. Are you saying that that problem is being addressed?

Matthew Hancock: I am. The new destination data, which was introduced this summer, will publish the destinations both of those who go to university and the proportion who go into apprenticeships. It is a major step forward.

Q215 Stephen Mosley: We have had some fantastic news on increasing apprenticeship numbers over the past two or three years, which is great. However, we have seen some evidence from the Royal Academy of Engineering that those increases in apprenticeships in general mask a decline in the number of apprenticeships in engineering and construction. Do you recognise that as a problem?

Matthew Hancock: We need to do everything we can to encourage apprenticeships in those areas. The number of apprenticeship starts in engineering and manufacturing has gone from 38,000 to 49,000-I shall get you the years for those figures-but I acknowledge that there is more to do. For instance, we have introduced a £25 million higher apprenticeship fund. We need to encourage the design of more higher apprenticeship qualifications, and these are best designed in strong collaboration with employers, and being employer led. I hope that companies will take up the challenge, and the funding is there to help them develop. For instance, they are being developed in space technology and environmental engineering and that sort of cutting-edge apprenticeship. We also have Doug Richard's report on the future of apprenticeships coming out before Christmas, and I expect that that will have a lot to say on this subject.

Q216 Stephen Mosley: Will it say things about engineering and construction specifically, rather than just the general issues?

Matthew Hancock: I expect it to be a wide-ranging report.

Those figures were 37,860 engineering and maths apprenticeships in 2009-10 and 48,970 engineering and manufacturing apprenticeships in 2010-11.

Q217 Stephen Mosley: I thank you for those figures, but they contradict what we have been told previously. That will be quite useful in our report.

Matthew Hancock: I am very happy to write to you with a more detailed breakdown of those figures.

Q218 Chair: But there has been a fall in engineering and construction apprenticeships.

Matthew Hancock: It is important to separate the two. As we know, across the economy the construction sector has not done very well recently. It is crucial that an apprenticeship has a job attached to it, because otherwise it is off-the-job training.

Q219 Chair: You can do something about that. My FE college, which was built a few years ago, is a rather splendid one that is doing fantastic work in partnership with local employers.

Stephen Mosley: Is that West Cheshire college? It has a great computing course.

Chair: The college, when it offered the contract out for tender, required contractors to provide a specified number of apprenticeships. As a procurer, the Government could do an awful lot more to incentivise in areas like construction. What are you doing about that?

Matthew Hancock: We have a pilot.

Q220 Chair: We've done it. You don't need a pilot. Just follow what we have done.

Matthew Hancock: There you are. The DWP is piloting this approach, and in its standard contract it has a schedule along those lines. I am looking with an eagle eye on the success of that, and especially on its implications for value for money. Of course, procurement has to be good value for money, too.

Q221 Graham Stringer: Why is the requirement for pupils to do a standard amount of work experience at key stage 4 being removed? I know that it is part of the Wolf recommendations, but beyond the fact that it is a recommendation, what are the deep underlying reasons for that?

Matthew Hancock: As you know, Professor Wolf is very keen to ensure that, within the occupational space, the experience of school is relevant to employers. In fact, the study programmes that we are introducing from 16 to 18 require work experience. The problem with the 14-to-16 requirement is that it was extremely highly specified, and it did not always work. In many cases, it led to people doing work experience-like activity, but the problem with that is that there is nothing like work experience except work experience. The way that it was designed was complicated and top-down, and it led to a poor-quality experience. Instead, we have freed up the curriculum to make sure that there is the flexibility to provide it. For 16 to 19-year-olds, we are requiring it as part of the programmes of study.

Q222 Graham Stringer: Do you have any idea how many schools have now cut back on work experience opportunities?

Matthew Hancock: I do not have those figures to hand. I am happy to write if we have them, but I would say in answering the question that we have to recognise the difference between genuine work experience, where the employer is engaged and the pupil is engaged, and something that is delivered in order to hit a top-down specification of what work experience looks like from a desk in Whitehall.

Q223 Chair: I have a question for you, Ms Truss, about the primary sector. A couple of years ago, the Royal Society of Chemistry and the Chemical Industries Association produced a DVD, a training pack, for teachers in the primary sector, to help them explain complex scientific concepts using everyday tools. It was especially targeted at teachers with no science background. Why is that not right at the heart of what the Department is doing?

Elizabeth Truss: I would say that it is. We are working on the new primary science curriculum, which is going to be released early next year. One of the things that we are specifically looking at is how to enable teachers in schools to access exciting materials that help to bring the subject to life for primary school children. Absolutely, we are talking to the Royal Society of Chemistry, which you mentioned, and other organisations precisely about those kinds of materials and opportunities, to help teachers who may not have a background in the subject to teach that subject. We are also keen to recruit more specialist teachers into primary school, and we are particularly rewarding teachers of maths, because the demand in the maths curriculum will increase in line with the experience in top-performing international jurisdictions. We are rewarding teachers who have A-level maths to come into primary school teaching. We are very much engaging with organisations that lead in the teaching and

understanding of subjects such as chemistry and physics, and making sure that primary schools are able to access those materials more easily.

I believe that we have a massive opportunity with this new curriculum, because when previous curricula were introduced, schools did not have access to high-speed broadband and thus opportunities to access materials not just from the UK but from some of the leading institutions, universities and societies around the world. There is a real opportunity for primary school teachers to take those materials into the classroom and to get children inspired very young. We talked earlier about programming and getting children coding from an early age in primary school, but we also want to get them involved in those kinds of practical science.

Q224 Chair: That leads me to my final question. As you are both here, can you tell us what discussions the two of you have had about one of our previous reports, when we looked at astronomy and the problems of continuing the National Schools' Observatory, which needs engagement between the research councils and education? You two are the bridge between those two areas, and areas like that where kids really get inspired by using modern technology to access facilities that are literally in the mid-Atlantic. What are you doing to make sure that that is an integral part of the tools available to the primary and secondary sectors?

Matthew Hancock: That sort of thing is vital. I well remember visiting Jodrell Bank as a youngster, and the inspiration that it gave me. Jodrell Bank is a little bit closer to where I grew up in Cheshire than the mid-Atlantic.

Q225 Chair: You went and did economics, for goodness' sake!

Matthew Hancock: I also worked briefly at the particle accelerator at Daresbury, which was very exciting.

May I add a point to my previous answer on new technologies in primary schools? This is a really important point throughout the curriculum. Freeing up the curriculum at all ages allows innovation, and there are huge innovations going on at the moment. India needs to train in basic English and maths half a billion people over the next 10 years. They are thinking really hard about how best to teach people when they have to get up to speed that quickly on that scale. We are already seeing the use of IT in teaching in American universities, with lecture series by the top professors being put online. In the States this is happening at a pace at university level. In emerging and fast-growing countries like India, it is happening in the skills sector at a huge pace. Across the country, here, we need to learn the lessons not only in primary schools but in post-16 education, for which I am responsible.

On the question that you actually asked, obviously the bridge between DFE and BIS is not yet built, but the buildings are very close together.

Elizabeth Truss: It is a virtual bridge.

Matthew Hancock: That is what we spend our time on.

Elizabeth Truss: Matt and I have a lot of conversations about various aspects of the curriculum, and we are developing things like the programme for 16 to 18-year-olds very

closely together. Matt spends a lot of time in the Department for Education. Our offices are closely situated-

Matthew Hancock: And we have neighbouring constituencies.

Elizabeth Truss: There is no shortage of interaction between us on all these critical matters.

Q226 Chair: Let me ask the question again. Can we tell the Royal Astronomical Society that you two are going to solve that problem?

Matthew Hancock: We are certainly going to look into it, and work towards-

Elizabeth Truss: In a seamless fashion.

Q227 Chair: You recognise, don't you, that that making that kind of tool available to schools-

Elizabeth Truss: That is what we want. We absolutely want more of those things in schools.

Chair: I am optimistic in looking forward to a solution to the problem. Thank you very much for your attendance this morning.