THE ROYAL SOCIETY

Royal Society response to the education Green Paper: Schools that work for everyone

12 December 2016

The Royal Society is the independent scientific academy of the UK. It is a self-governing Fellowship of many of the world's most distinguished scientists working in academia, charities, industry and public service. It draws on the expertise of the Fellowship to provide independent and authoritative advice. This submission has been developed through consultation with the Fellowship, and contains evidence from newly-commissioned research.

The Government's aspiration for a school system that extends opportunity to everyone is one that the Society shares. This submission considers the potential impact of the Government's proposals on science, technology, engineering and mathematics (STEM) subjects, with particular reference to pupils who are eligible for free school meals (FSM).

The Royal Society believes that two aspects of social mobility are essential for the nation's health in regard to STEM: (i) the most able pupils from every background should have the opportunity to excel, and also (ii) all pupils must be supported to reach their full potential. A number of different policy measures will be required to improve the social mobility of students with different abilities.

Education in science and mathematics develops the natural intellectual curiosity and creativity of all young people, providing knowledge and understanding of how the world works and opportunities to live rewarding lives. The UK also has a longstanding shortage of STEM skilled professionals in the face of ever rising demand. The demand for increased skills must be met by all young people having access to a curriculum encompassing vocational and academic learning across a broad range of subjects to 18 including maths and science but also the arts, social sciences and humanities.

The Government has proposed that universities should play a direct role in improving pupils' attainment. The Society's view is that improving the participation of young people in STEM apprenticeships, higher education and careers requires efforts to raise attainment alongside measures to increase every day engagement with science and interactions with people involved in science.

Raising attainment can best be achieved by enabling more pupils to be taught by specialist teachers, not just the most able. Inspiring teachers with a thorough understanding of their subject are fundamental to high quality STEM education. Specialist science and mathematics teachers are more able to engage pupils with their subject and motivate them towards considering a STEM career. Our response sets out ways universities and independent schools could help to increase the number and confidence of STEM teachers, but we note that state sector schools do not always have access to local universities or independent schools.

Universities can also provide access to those involved in STEM as well as supporting existing collaborative initiatives that engage young people to take part in science activities beyond the classroom. However, high-quality and effective collaboration between institutions will only be achieved with investment in time and resources for all partners.

The Society has considered existing evidence and commissioned fresh research specifically on the issue of attainment and participation in STEM subjects of FSM pupils in selective and non-selective schools. As a result we are concerned that the approach to selective education outlined in the Green Paper may only support a small proportion of disadvantaged pupils. From the research we have commissioned, we have found no evidence to suggest that overall educational standards for FSM pupils taking STEM subjects in England would be improved by an increase in the number of places in selective schools.

1. Can independent schools support STEM teaching in state schools?

1.1. Introduction

1.1.1. The Royal Society welcomes the Government's aim to ensure that independent charitable schools provide a public benefit for young people irrespective of their background. If the resources of independent schools can be used to support science education more widely then this would be a positive step.

1.1.2. There are around 1,000 members of the Independent Schools Council with charitable status compared to 24,000 state schools in England. The proposals can only therefore support a small proportion of state schools.

1.2. Attainment in independent schools

1.2.1. Research undertaken by the Independent Schools Council (ISC) has shown that there is a significant gap between independent and state schools performance (about 2 GCSE grades).This gap shrinks considerably (to 0.64 grade at GCSE) once the data is controlled for prior academic attainment and school-level factors.[1]

1.2.2. However, it cannot be taken for granted that independent schools provide higher quality education than state schools. The researchers found the differences in attainment between pupils in state and independent schools varied by subject, and that the lowest differences in attainment were in biology, chemistry and physics. There are also many state schools with higher performance than their local independent schools, and there are regional variations in state school performance.[2]

1.3. Priorities for support for state schools from the independent school sector

1.3.1. The resources of independent schools could most effectively be used to improve access to subject-specialist STEM teaching within state schools.

1.3.2. Inspirational teaching begins with 'teachers who know and love their subject'.[3] Science and mathematics in particular are best taught by teachers who have chosen to specialise in these subjects. One of the main barriers to the UK's capacity to offer high-quality science and mathematics learning to all young people is the persistent shortage of suitably qualified teachers in some STEM subjects.[4]

1.3.3. Independent schools could contribute to alleviating these shortages by enabling their specialist teachers to teach disadvantaged state school pupils. Experienced subject-specialist teachers from independent schools could also provide training for science and mathematics teachers in state schools to raise their subject confidence and specialist skills. Many independent schools have high-quality science facilities, beyond those available to most state schools. These schools could provide nearby state schools with access to these facilities.

[1] Independent Schools Council - A comparison of Academic Achievement in Independent and State Schools

[2] Telegraph – State pupils put private schools in the shade

[3] Department of Business, Innovation and Skills 2010 Science and mathematics secondary education for the 21st century. Report of the Science and Learning Expert Group. London: DBIS.

[4] Royal Society, 2014, Vision for science and mathematics education

2. What role can universities play in improving progression of disadvantaged pupils to STEM higher education?[5]

2.1. Introduction

2.1.1. Universities have made progress in widening participation in recent years. Following reforms to higher education carried out by the coalition government, the 108 universities and colleges in England have to provide an access agreement to charge a higher rate of fees for undergraduates. Since 2012, there has been a rise in the number of undergraduate students[6], including a slow but consistent increase in the proportion of students from low participation neighbourhoods.[7]

2.1.2. Disadvantaged communities remain underrepresented in their participation in higher education. In STEM subjects there are particular additional challenges such as the low rate of progression to higher education of girls in physics.[8]

2.1.3. One of the main barriers to disadvantaged pupils accessing higher education is their lower attainment outcomes throughout school. The Russell Group's Opening Doors report illustrates that the attainment gap between advantaged and disadvantaged pupils appears by the age of 3 and is deeply entrenched by age 10.[9] The attainment gap between Free School Meals (FSM) pupils and non-FSM pupils was 26.7% in 2012. This attainment gap makes it harder for universities to recruit pupils from disadvantaged backgrounds as the pool achieving the entry standards is smaller.

2.1.4. A focus on attainment alone is insufficient for addressing parity. Research undertaken by academics from Durham University has indicated that even with the same attainment, disadvantaged pupils are less likely to both apply and be admitted to Russell Group institutions and that this is especially acute for ethnic minority pupils.[10]

2.1.5. Other factors including aspirations, subject-choice and science capital can affect pupils' decision making about progression to STEM degree courses.

- Beyond attainment, the Russell Group has pointed out that poor advice and guidance available in the state sector may be contributing to low progression rates in many comprehensive schools and further education colleges.[9]

- Academics at King's College London have developed a concept of science capital, similar to the ideas of cultural capital. Their research shows that a wide range of factors impact on progression, in addition to attainment. An acute example of this is in physics where there is a large pool of young women with high attainment at age 16, few of whom choose to progress to A levels. [11]

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[5] Note: Throughout this section disadvantaged is used as a catch all term rather than specifically referring to FSM pupils, low SES or any other specific categorisation.

[6] DFE - Participation rates in higher education: 2006 to 2015

[7] HESA - Performance indicators in higher education in the UK 2014/15

[8] Institute of Physics (2012) – Physics Students in UK Higher Education Institutions

[9] Russell Group – Opening Doors

[10] Dr V Boliver, University of Durham - How fair is access to more prestigious UK universities?

[11] Kings College London (2013) - ASPIRES report

2.2. University support for science and mathematics teachers

2.2.1. The Society recognises that the relatively small number of universities with science, mathematics or engineering departments, and their locations, limit the potential impact universities can have on state schools. However, we urge the Government to place a focus on using the resources of universities to improve access to subject-specialist STEM teaching within state schools through funded, collaborative partnerships with schools and organisations.

2.2.2. Mathematics and science are best taught by teachers with subject specialist knowledge. As outlined in the previous section (1.3.2), there are significant benefits in STEM subjects for pupils to be taught by teachers with subject specialist knowledge, in particular regarding raising the attainment and improving the progression of pupils.

2.2.3. There are not enough subject-specialist teachers, with particularly long-standing and acute shortages in physics, chemistry, mathematics and computing. With sufficient resources, universities could contribute to alleviating these shortages by the following:

- Promoting teaching as a career option early in undergraduate and postgraduate courses and as an option for post-doctoral researchers.
- Offering more joint degrees between a STEM subject and teaching, which ultimately lead to qualified teaching status.
- Offering modules within undergraduate degree courses introducing teaching to undergraduates.
- Supporting post-doctoral researchers who might like to combine teaching in school with research. Researchers in Schools is a scheme that sets out to facilitate this.[12] Science and mathematics departments might also offer appropriate associate membership to local school teachers with post-doctoral research experience or PhDs in science or mathematics.

2.2.4. An effective education system is underpinned by a strong culture of professional development.[13] If funding was available, universities could undertake some of the following activities to develop the knowledge and confidence of existing teachers:

- Providing opportunities for teachers to spend sabbaticals or periods during the summer in university research departments to refresh their subject knowledge.
- Running subject-specific courses that are informed by education research and to promote deep subject knowledge and enhance pedagogical skills.
- Providing the latest research, including education research, in an accessible form for teachers through teaching journals and publications.
- Collaborating with organisations such as the Institute of Physics, Royal Society of Chemistry, Royal Society of Biology, British Computing Society, London Mathematical Society, Institute of Mathematics and its Applications, STEM Learning and subject associations that provide CPD opportunities for teachers across the whole of the UK.

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[12] Researchers in Schools – Maths and Physics Chairs Programme

[13] ACME - Empowering teachers: success for learners

2.3. Universities' role in building the 'science capital' of disadvantaged pupils

2.3.1. As outlined in 2.1.5, improving progression to STEM higher education courses alongside raising attainment will be necessary to build the science capital of disadvantaged pupils. Examples of effective ways in which universities can work directly with pupils to raise their engagement with science and awareness of STEM degree pathways include:

- Providing disadvantaged school pupils with opportunities to experience a university academic environment in order to appreciate what life is like as a higher education science student. This could take the form of schemes such as the Sutton Trust's summer schools, which have been found to generate an increased proportion of UCAS applications from participants. The Sutton Trust scheme has a significant impact on disadvantaged pupils, who after participating are much more likely to apply to elite universities.[14,15]

- Providing school pupils with the opportunity to learn science from current academics and higher education students.

- Providing advice and guidance to schools and disadvantaged pupils on the universities admission process to demystify the routes to university.

2.4. Universities role in curriculum development

2.4.1. When national qualifications are reviewed and revised, there are opportunities for representatives from academic disciplines to be involved in the creation of new school examinations, including:

- The advice of academics is often sought during curriculum and qualification reviews. During recent A level reforms, the A level Content Advisory Board (ALCAB) initiative led by the Russell Group enabled the Department for Education's new A level criteria for mathematics, further mathematics, modern foreign and classical languages and geography to be developed by expert panels consisting of academics, teachers and industry representatives.[16]

- The Institutes of Physics, Royal Society of Chemistry and Royal Society of Biology each have curriculum panels that are developing guidance on primary and secondary school science curricula.

- University academics can also be involved in the setting of annual examinations, usually as members of an awarding organisation reference group.

2.4.2. The Government's aspiration for universities to support raising attainment in schools must be complemented by other activities to improve progression to STEM higher education for disadvantaged pupils. Decisions on the terms of an access agreement should be based on evidence about the impact of various approaches to raising the attainment and progression of all pupils.

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[14] Sutton Trust - The impact of the Sutton Trust's Summer Schools on subsequent higher education participation

[15] Windsor Fellowship - Destination STEMM project

[16] ALCAB - The A-Level Content Advisory Board

2.5. University support for experimental science in schools

2.5.1. There are good examples where universities have partnered with schools to support teaching of STEM subjects beyond the school sponsorship model.

2.5.2. Research by the Wellcome Trust suggested that pupils who undertake STEM research projects have improved attitudes to STEM subjects and are more likely to consider a career in science.[17] Independent research projects can be supported by researchers in universities, for example the Society's Partnership Grants enable scientists in universities and industry to work with schools on science research projects.

2.5.3. Similar schemes have demonstrated improved progression to STEM A Levels for pupils with matched attainment. The British Science Association's CREST Silver Awards are achieved by pupils completing a 30 hour long project. The awards are aimed at 14 to 16 year olds to give young people a chance to develop their own project idea and gain experience of the scientific process. Many of these projects are supported by scientists and engineers from universities and industry. An impact evaluation of this scheme found that participation in the scheme significantly increases progression from GCSE to A levels, especially for FSM pupils.[18] The Education Endowment Foundation is now funding a randomised control trial of this scheme.

2.5.4. Initiatives like IRIS, which facilitates collaboration between schools and researchers, can enable young people to undertake authentic scientific research, giving an insight into a future STEM career. It also enables teachers to develop their own research interests so they can keep up to date and maintain a passion for their subject. [19]

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[17] Wellcome Trust – Young Researchers: Reflections from Wellcome on the impact of doing research projects

[18] British Science Association - CREST Silver Awards: impact report

[19] IRIS – The Institute for Research in Schools

3. Can selection be effective in supporting disadvantaged pupils' participation, attainment and progression in STEM education?[20]

3.1. Introduction

3.1.1. Social mobility is a broad concept used to describe how someone's adult outcomes relate to their childhood circumstances. There is no consistent approach used to define social mobility. It may include income, educational attainment and occupation.[21] Achieving improvement in any aspect of social mobility is difficult and requires many factors to work together.

3.1.2. The Society welcomes the aim to improve opportunities for disadvantaged pupils, including improving the participation of disadvantaged students in higher education. As a leading scientific nation, the UK needs to ensure that the most gifted young scientists are able to excel whilst enabling all pupils to reach their full potential. Different policy measures may be required to improve the social mobility of students with different abilities. Surveys carried out by Ofsted have shown that thousands of pupils who achieved well in primary school failed to reach their full potential after age 11, especially those from disadvantaged backgrounds.[22]

3.1.3. There is limited research to draw on to inform policy on selection, attainment and social mobility. The research that is available needs to be considered with caution. To inform our response we commissioned new research on the impact of selection on STEM attainment and progression.

3.2. Selection and attainment

3.2.1. Selection can be an effective way of providing appropriate education for the most able young people. Research by Ofsted has shown that the attainment of the most able pupils in year 6 in mathematics is better at GCSE Mathematics if they attend selective state schools. In 2014, of pupils who attained Level 5 at Key Stage 2, 75% of those in selective schools achieved an A* or A grade compared with 42% in non-selective schools.[23]

3.2.2. Pupils who attend selective schools are more likely to have higher attainment than those who attend non-selective schools and to progress to A level in STEM subjects. While selective schools only account for around 5% of pupils, in 2014 selective schools accounted for 10.6% of A level Mathematics, 8.5% of A level Further Mathematics, 8.7% of A level Physics, 8.1% of A level Chemistry and 9.0% of A level Biology entries.[24]

3.3. Selection and disadvantage

3.3.1. Disadvantaged pupils attending selective schools achieve higher attainment than similar pupils attending non-selective schools.[25] However at present, these pupils are less likely to attend selective schools. Research by the Institute for Fiscal studies in 2013 found that only around 3% of selective school pupils are eligible for FSM (compared to 13.2% of all secondary school pupils).[26] This is partly explained by the attainment at age 11 for FSM pupils being lower with only 25% achieving Level 5 in Key Stage 2 Mathematics compared to 45% of pupils not eligible

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[20] Note: Throughout this section disadvantaged is used as a catch all term rather than specifically referring to FSM pupils, low SES or any other specific categorisation.

[21] BIS, 2011 – Social Mobility: A Literature Review

[22] Ofsted June 2016 - HMCI's monthly commentary

[23] Ofsted June 2013 - The most able students

[24] JCQ – Inter-Awarding Body Statistics Winter 2013/14 & Summer 2014

[25] Atkinson, Greg, McConnell (2006) - The result of 11+ Selection

[26] DFE January 2016 - Schools, pupils and their characteristics

for FSM. [27] Pupils who attend non-selective schools in selective areas make less progress than they otherwise would.[28]

3.4. Selection and attainment in mathematics at GCSE

3.4.1. The Royal Society commissioned research by the Education Policy Institute (EPI) to look at the attainment of FSM pupils in selective school areas in GCSE Mathematics in 2015. [29,30] The key findings were:

- While FSM pupils who attend selective schools have high attainment, overall FSM pupils have lower attainment in GCSE Mathematics in selective school areas than in non-selective school areas (see Table 1a).

- In 2015 83.6% of FSM pupils in selective schools attained a GCSE grade B or above in Mathematics, compared to 91.7% of non-FSM pupils at selective schools. 98% of FSM pupils in these schools attained a grade C compared with 99.2% of non-FSM pupils (see Table 1a).

- As referenced in 3.3.1, only around 3% of selective school pupils are eligible for FSM compared to 18% of pupils at non-selective schools in wholly selective local authorities.

- In the non-selective schools in wholly selective school areas, only 39.5% of FSM eligible pupils achieved a grade C or above, compared to 48.1% in non-selective school areas. For grade B and above the figures are 13.2% to 19.4% respectively. These differences are not accounted for by the small number of FSM pupils who attend selective schools (see Table 1a).

- Considering the FSM pupils in an area as a whole, we find that in wholly selective areas FSM pupils are less likely to achieve a GCSE grade C or above in Mathematics than those in non-selective areas. They are also less likely to achieve a GCSE grade B or above. However, non-FSM pupils are more likely to achieve a GCSE grade B or above (see Table 1b).

[27] Institute for Fiscal Studies – Entry into Grammar school

[28] Education Data Lab 2016 – Grammar Schools Research Briefing

[29] Research commissioned from the Education Policy Institute

[30] Note: This research considers the total number of FSM and non FSM pupils in selective and non-selective areas. Data were not matched for prior attainment.

Table 1a	Attained at least a grade B at GCSE		Attained a least a grade C at GCSE	
	FSM	Non-FSM	FSM	Non-FSM
Selective schools	83.6%	91.7%	98.0%	99.2%
Non-selective schools in wholly selective local authorities	13.2%	28.9%	39.5%	63.4%
Non-selective schools in non-selective local authorities	19.4%	40.6%	48.1%	72.4%
Non-selective schools in partially selective local authorities*	18.9%	39.3%	47.5%	71.3%

Table 1b	Attained at least a grade B at GCSE		Attained a least a grade C at GCSE	
	FSM	Non-FSM	FSM	Non-FSM
Non-selective areas	19.6%	40.6%	48.1%	72.4%
Partially selective areas*	19.9%	43.7%	48.2%	73.5%
Wholly selective areas	18.1%	48.5%	43.9%	74.8%
Areas with any selection*	19.5%	45.1%	47.3%	73.9%

*As these categories include many local authorities with just a single selective school, we have focused on wholly selective authorities and entirely non-selective areas in our analysis.

3.4.2. This research suggests that selective schools have an overall negative impact on the attainment of all FSM pupils in GCSE Mathematics in selective areas. The small numbers of FSM pupils who benefit from attending selective schools are outnumbered by the larger pool of FSM pupils who attend non-selective schools in selective local authorities who have lower attainment in GCSE Mathematics.

3.5. Selection and participation in science at GCSE

3.5.1. The Society also asked EPI to look at the participation of FSM pupils in selective school areas in GCSE science subjects in 2015. The research looks at participation in triple and double science, which are components of the English Baccalaureate.

3.5.2. Pupils who attend selective schools are overwhelmingly entered for triple science and most are entered for at least double science. This is true of both non-FSM and FSM pupils with 68% of FSM pupils and 73.7% of non-FSM pupils entered for triple science (see Table 2a).

3.5.3. Overall FSM pupils in selective school areas are less likely to undertake triple or double science than FSM pupils in non-selective school areas (see Table 2a).

- In the non-selective schools in wholly selective school areas, only 4.5% of FSM eligible pupils were entered for triple science, compared to 9.4% in non-selective school areas.

- In the non-selective schools in wholly selective school areas, only 46.7% of FSM eligible pupils were entered for double or triple science, compared to 58.2% in non-selective school areas.

3.5.4. As referenced in 3.3.1, only 3% of selective school pupils are eligible for FSM and this compares with 18% of pupils at non-selective schools in wholly selective local authorities. Therefore the differences between participation in triple and double science between non-selective schools in selective school areas and non-selective school areas is not accounted for by FSM pupils attending selective schools.

3.5.5. Considering the FSM pupils in an area as a whole, we find that in wholly selective areas FSM pupils are less likely to be entered for triple science than in non-selective areas. They are less likely to be entered for triple science or double science than FSM pupils in non-selective areas (50.4% versus 58.2%). They are therefore much more likely to take a single science or other science qualification than FSM pupils in non-selective areas.

Table 2a	**Triple science**		**Double science**		**Any science**	
	FSM	**Non-FSM**	**FSM**	**Non-FSM**	**FSM**	**Non-FSM**
Selective schools	**68.0%**	**73.7%**	**26.7%**	**19.5%**	**2.9%**	**3.8%**
Non-selective schools in wholly selective local authorities	**4.5%**	**11.3%**	**42.2%**	**57.4%**	**32.1%**	**20.4%**
Non-selective schools in non-selective local authorities	**9.4%**	**22.2%**	**48.8%**	**56.6%**	**21.7%**	**11.8%**
Non-selective schools in partially selective local authorities*	**9.9%**	**22.8%**	**47.0%**	**54.9%**	**21.9%**	**12.2%**

Table 2b	**Triple science**		**Double science**		**Any science**	
	FSM	**Non-FSM**	**FSM**	**Non-FSM**	**FSM**	**Non-FSM**
Non-selective areas	**9.4%**	**22.2%**	**48.8%**	**56.6%**	**21.7%**	**11.8%**
Partially selective areas*	**10.8%**	**27.4%**	**46.6%**	**46.6%**	**21.6%**	**11.5%**
Wholly selective areas	**8.8%**	**29.9%**	**41.6%**	**46.9%**	**29.9%**	**15.1%**
Areas with any selection*	**10.4%**	**28.1%**	**45.5%**	**50.1%**	**23.4%**	**12.5%**

*As these categories include many local authorities with just a single selective school, we have focused on wholly selective authorities and entirely non-selective areas in our analysis.

3.5.6. This research suggests that selective schools have an overall negative impact on the total participation of FSM pupils in double and triple GCSE Science. The small numbers of FSM pupils who benefit from attending selective schools are outnumbered by the larger pool of FSM pupils who attend non-selective schools in selective local authorities who have lower participation in double and triple GCSE Science.

3.6. Selection and the overall impact on progression to STEM courses in higher education

3.6.1. The Society also asked the Institute for Fiscal Studies to look at the choices pupils from selective school areas made for progression to university.[31] The study compared the subject choices of students who went to school in selective areas and subsequently went on to university at age 18 or 19 with the subject choices of university students who went to school in a group of non-selective areas in England with similar characteristics to the selective areas.

3.6.2. Comparing individuals with similar characteristics on arrival at primary school, there are slight differences in the number of university students from selective school areas and non-selective school areas taking STEM courses. (Any courses within the JACS categories Biological Sciences, Physical Sciences, Mathematical Sciences, Computer Sciences and Engineering and Technology. We note that medicine and subjects allied to medicine have not been considered here.) (see Table 3).

Table 3	**Matched areas**	**Selective school areas (accounting for differences up to end of primary school)**
Biological Sciences	**6.7%**	**6.2%**
Physical Sciences	**3.7%**	**3.6%**
Mathematical Sciences	**1.9%**	**1.6%**
Computer Sciences	**3.7%**	**3.0%**
Engineering and Technology	**5.2%**	**4.8%**

3.6.3. University students with low social and economic status (SES) from selective school areas were less likely to study Biological Sciences and Computer Science courses than those from matched areas. They were more likely to be taking Engineering and Technology courses (see Table 4).

[31] Research commissioned from the Institute for Fiscal Studies

Table 4	Low SES in matched areas	Low SES in selective school areas (accounting for differences up to end of primary school)
Biological Sciences	**7.6%**	**5.3%**
Physical Sciences	**2.4%**	**2.2%**
Mathematical Sciences	**1.3%**	**1.3%**
Computer Sciences	**5.9%**	**4.4%**
Engineering and Technology	**3.6%**	**4.5%**

3.6.1. Female university students from selective school areas were slightly more likely to be taking Engineering and Technology Courses, although this effect was reduced once account was taken of whether the school attended was single or mixed sex. They were less likely to be taking Biological Sciences (see Table 5).

- The Institute of Physics in 2012 found that girls were significantly more likely to take A level Physics if they attended an all-girls school.[32]

Table 5	Female students in matched areas	Female students in selective school areas (accounting for differences up to end of primary school)
Biological Sciences	**5.6%**	**5.1%**
Physical Sciences	**2.5%**	**2.6%**
Mathematical Sciences	**1.2%**	**1.1%**
Computer Sciences	**0.9%**	**0.9%**
Engineering and Technology	**1.3%**	**1.6%**

3.7. Impacts of selective schools on the teaching workforce

3.7.1. Selective schools are more able to recruit and retain teachers and make it harder for other local schools to do so. This is especially true for subject specialist STEM teachers. [33]

[32] Institute of Physics 2012 – It's different for girls: The influence of schools

[33] Education Data Lab 2016 - Inequalities in access to teachers in selective schooling areas

3.7.2. Research carried out by the Education Data Lab in 2016 found that in teachers in both mathematics and science at selective schools were significantly more likely to have an academic degree in their subject than teachers of the subjects at non-selective schools.

3.7.3. The research also showed that in selective areas, the non-selective schools had a lower proportion of mathematics or science teachers with degrees in their subject compared with non-selective schools in non-selective areas.

3.8. Conclusions

3.8.1. The Government has stated that its aspiration with these reforms is to improve social mobility. The Society supports the Government's aspiration but given the complexity of social mobility, we are concerned that the approach to selective education outlined in the Green Paper may only support a small proportion of disadvantaged pupils. As PISA 2015 results indicate, it is very unusual for a selective education system to improve educational equity. The earlier school-level selection takes place, the greater the inequity in the PISA outcomes.[34]

3.8.2. For the UK's future prosperity, high quality mathematics and science education are needed throughout our education system. Citizens should be equipped to make informed judgements about contemporary scientific issues or decisions, for instance on medical treatments, based on an informed understanding of the risks and ethics. Creative scientists, mathematicians and engineers must also be complemented by highly skilled technicians. The Society believes all pupils should be enabled to reach their full potential, irrespective of their ability.

3.8.3. From the research we have commissioned, we have found no evidence to suggest that overall educational standards for FSM pupils in STEM subjects in England would be improved by an increase in the number of places in selective schools.

3.8.4. The small number of FSM eligible pupils who attend selective schools have high attainment in GCSE maths and high participation in GCSE triple science.

3.8.5. The research carried out by EPI shows that FSM eligible pupils' GCSE attainment in mathematics is lower in wholly selective school areas than non-selective school areas. It also shows that their participation in GCSE double and triple Science is lower in wholly selective school areas.

3.8.6. Teachers with subject specific expertise are more likely to teach in selective schools and are less likely to teach in non-selective schools in selective areas. Specialist science and mathematics teachers are particularly able to inspire and enthuse their pupils in their subjects.

3.8.7. Irrespective of whether selective schools are to play a larger role in England's education system in future, priority should be placed on ensuring that all young people receive high-quality science and mathematics education.

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[34] OECD – PISA 2015