Written evidence submitted by Northumbria University (GAP0078)

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This evidence is submitted as a result of our experience with NUSTEM, (previously Think Physics), an outreach and widening participation team that works in partnership with industry, and science and education organisations in the North East of England to address the STEM skills gap, with a particular focus on encouraging females and other under-represented groups to consider a career in physical sciences, technology and engineering. It also draws on our wider experience as a university with supporting STEM education through development of higher level skills and associated research.

Executive Summary

- Children make career-limiting choices early in their school careers
- Interventions targeted at secondary school children have had limited effect in increasing the number of young people interested in a career in STEM, particularly from under-represented groups.
- To address the STEM skills gap (i.e. increase the number of young people studying STEM subjects) interventions need to be started at primary school age or earlier, and continue throughout a child’s education.
- Interventions also need to be targeted at the key influencers of these children i.e. parents and carers and primary school teachers.
- Science capital is a useful concept when considering how to increase the likelihood of children and young people choosing a STEM career.
- NUSTEM have worked closely with primary schools in under-served areas to increase the likelihood that young people will see a STEM career as being possible for ‘people like them’.
- There is evidence of a leaky pipeline. We need to open doors to STEM throughout a person’s career, not close them down.
- We need to address the gender gap and encourage more females to choose physical sciences, engineering and technology.
Further Information

1. Over the past 30 years there have been many initiatives aimed at increasing the number of young people entering STEM careers. There have been a number of attempts to identify these initiatives and their effects\textsuperscript{1,2,3}. A number of these initiatives have been focussed on (often high achieving) young people in school years 10 – 12, prior to key choice points in their school life. Others were aimed at ‘inspiring’ young people with or about STEM. However, there has not been a corresponding increase in the number of young people choosing to study STEM.

2. Research carried out by the ASPIRES team at UCL\textsuperscript{4} has identified that a high proportion of children and young people between the ages of 10 and 16 enjoy science, and believe that it is important for the future. However, only a small percentage of students want to be a scientist\textsuperscript{5}. This is representative of the STEM sector as a whole.

3. ASPIRES researchers use the concept of ‘science capital’ in their research. Science capital is a portmanteau concept which encompasses a number of dimensions including:
   - Talking and reading about science at home
   - Knowing people who use science in their jobs
   - Visiting science-related places and activities as a family

4. High science capital is often found amongst those young people and families from a socially advantaged demographic. High science capital correlates with an increased likelihood of children pursuing a STEM career\textsuperscript{6}.

5. NUSTEM supports the development of science capital in children from under-served areas, across primary and secondary schools. Working with 30 partner schools we have developed a programme which includes: careers focussed workshops for children, collaborative workshops for families, and CPD for teachers. By involving the child and their influencers we aim to normalise science and technology conversations and ideas including careers, across a child’s environment, not just in the classroom.

6. NUSTEM is researching the effects of the programme on children in partner schools to identify changes measures for science capital, initially over 3 years\textsuperscript{7}. We believe that by

\textsuperscript{2} Royal Academy of Engineering (2016) The UK STEM Education Landscape, ISBN: 9781909327252
\textsuperscript{3} Banerjee P.A. (2015), Impact assessment of STEM initiatives in improving educational outcomes, Durham theses, Durham University
\textsuperscript{4} http://www.kcl.ac.uk/sspp/departments/education/research/ASPIRES/Index.aspx
\textsuperscript{5} http://blogs.kcl.ac.uk/aspires/i-still-like-science/
increasing the science capital of a child/family, and by supporting the teaching of science in a careers context from primary schools upwards, ultimately we will increase the number of young people who choose a STEM career.

7. Northumbria University is committed to supporting the development of people with higher level STEM skills and welcomes the introduction of degree apprentices as an alternative pathway into higher education. However, care needs to be taken that these apprenticeship standards are developed in a coherent manner to provide a structured pathway from lower levels to postgraduate and beyond. The current approach with approval of each individual standard may provide a disjointed set of standards. Education and training providers should be integrated more fully into the development process, working in partnership with employers. Furthermore, the apprenticeship system needs to be simplified to ensure all employers including SMEs can engage and access it easily.

8. More funding and investment is needed to develop pathways back into STEM for those that have studied non-STEM subjects, to make it easy for people to transfer across at all stages of their career. This could include two year Masters programmes developed with industry and other initiatives such as digital skills bootcamps.

9. There needs to be a concerted effort to address the gender gap, particularly in the physical sciences, engineering and technology. This starts from birth with ‘pink for a girl’ and ‘blue for a boy’. There is research evidence indicating, for example, girls are more interested in the application of physical sciences, engineering and technology, and thus it is important that approaches are changed within education and industry to address these research findings and ensure environments are supportive for both females and males. Messaging in wider society needs to also be supportive.

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NUSTEM

at Frontiers in Education 2016.