



EXECUTIVE SUMMARY

Subject Choice in STEM:
Factors Influencing
Young People (aged 14–19)
in Education

A systematic review of the UK literature
October 2010

Subject Choice in STEM: More questions than answers

A summary of *Factors Influencing Young People (aged 14-19) in Education about STEM Subject Choices: A systematic review of the UK literature*

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Introduction

Everyone has to make choices at different stages in their life. Some of the most crucial relate to their education, in particular what combination of subjects they decide to take for higher-level study. For most young people such choices take place between the ages of 14 and 18. In England they are likely to be asked to make selections at 14, when they decide which GCSE courses they are to pursue, at 16 when they select their post-16 studies and then at 18 in deciding on higher or further education programmes or their chosen area of employment.

As important as these choices are for individuals, such decisions also have wider economic implications for the country. This is particularly the case with STEM (science, technology, engineering and mathematics) subjects. Major government-funded inquiries (e.g. Roberts, 2002; Smith, 2004)¹ identified a mismatch between skills acquired during formal education and those required in the workplace. This phenomenon is not unique to the UK, with many OECD countries facing similar difficulties in terms of student participation in STEM (OECD Global Science Forum, 2006).

In common with other countries the UK government is committed to fostering STEM-related innovation in the UK. The Science and Innovation Investment Framework 2004-2014 (HM Treasury, 2004; 2006) set out priorities for addressing skills shortages. Improving education in the STEM subjects was identified as a key element, leading to the STEM Programme that was launched in October 2006. This provides a strategic framework through which support for STEM subjects in schools and colleges is made more effective and more accessible (DfES, 2006). A key premise underpinning many of the proposals is the view that young people begin to make choices about careers early in their education.

Helping young people to make the most appropriate subject choices is therefore crucial, both to ensure that the country has the skills its needs for the economy and to enable young people to make the best choices to meet their own future needs and aspirations.

Aim of the review

Against this background, the Wellcome Trust commissioned the Evidence for Policy and Practice Information and Co-ordinating Centre (EPPI-Centre) to undertake a systematic review to examine why young people make the subject choices they do. The review specifically addressed the question: 'What factors influence the STEM subject choices of young people (aged 14-19) in education in the UK?'

Outcomes of the review

The most striking outcome of this review has been to highlight the underlying challenges faced in building research capacity. Student choice is a significantly under-investigated area. Even where research exists, the lack of resources and expertise severely limits the extent to which the findings can be relied upon to provide a robust evidence base for action.

For the purposes of this review, 25 studies met the criteria to be included for in-depth analysis but only 12 were judged to be of medium to high overall quality. Synthesis of the studies was

¹ For references, see main report - *Factors Influencing Young People (Aged 14-19) in Education about STEM Subject Choices: A systematic review of the UK literature* - www.wellcome.ac.uk/STEMsubject.

hampered because although some of the studies included considerable amounts of data, only a small proportion of this dealt specifically with subject choice. The wide range of factors considered by the different investigations further reduced the potential for reliable synthesis of the available evidence.

Reflection on the outcomes of the review emphasises the many challenges - small sample sizes, short-term 'snapshot' approaches, inconsistent analysis, imprecise terminology and overreliance on historical (pre-2000) data - that have to be overcome to produce the high-quality research overview needed to provide reliable conclusions from which policy and practice can be developed.

The findings of this work illustrate the urgent need to build a reliable evidence base that better informs why young people make the subject choices they do. Some larger-scale studies are already underway, such as those commissioned under the Economic and Social Research Council's targeted initiative on science and mathematics education. There are also opportunities for building capacity in this area, including the exploitation of the large datasets, such as the National Pupil Database, which have been established and lend themselves to cohort studies of young people as they move through their education.

Building capacity in this area is essential as robust research evidence is important not only to ensure that the right skills are available to support the future economic wellbeing of the country but also to better advise the young people themselves.

Summary of the review

The review was designed in two stages to address the following overarching questions:

1. What is the nature and extent of the research that has been undertaken in OECD countries on the factors that influence young people (aged 11-19) in education, or their parents, in relation to subject choices?
2. What factors influence the STEM subject choices of young people (aged 14-19) in education in the UK?

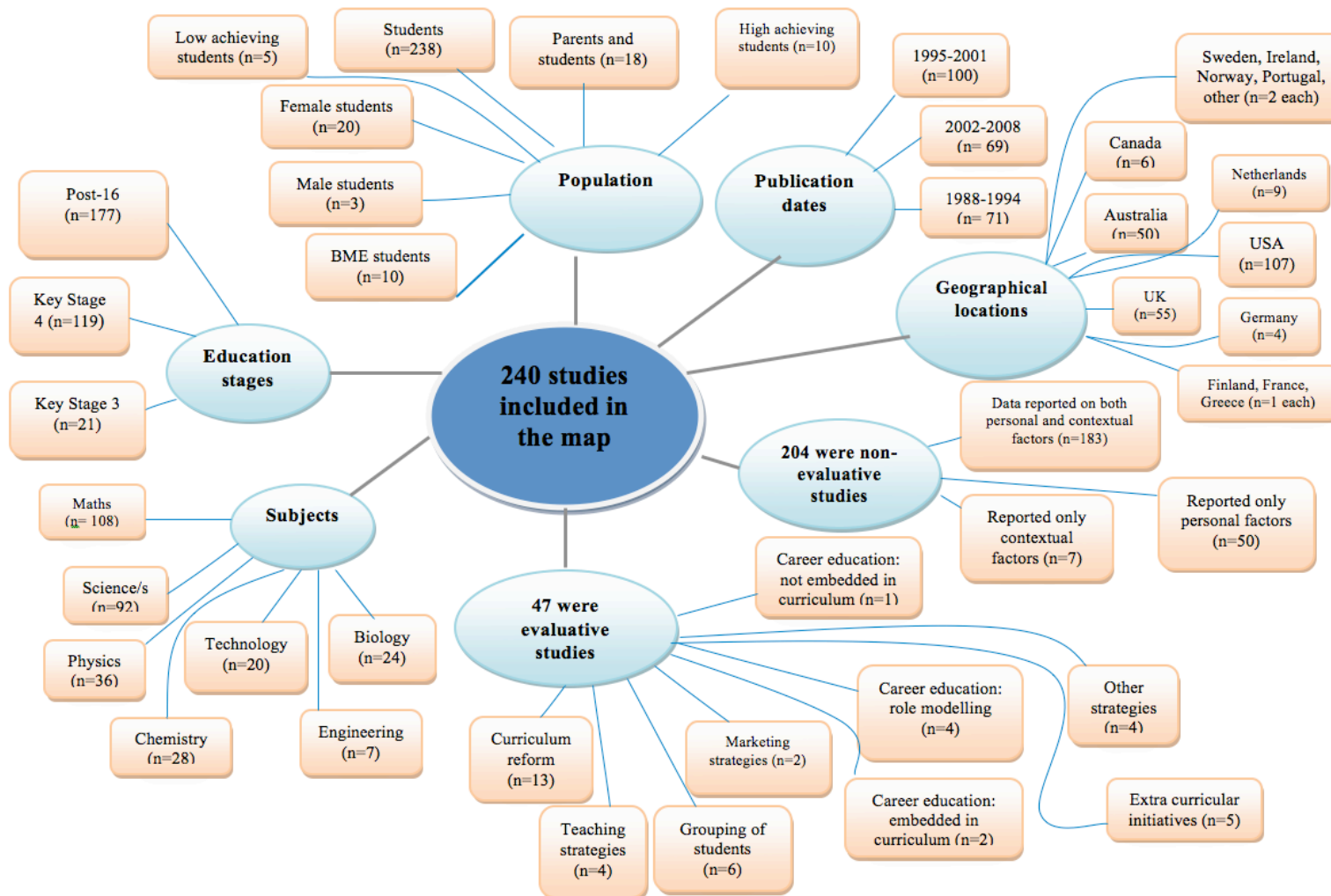
In doing so, the review was intended to:

- produce a systematic map describing the nature and extent of research investigating factors influencing young people in education (11-19 years) or their parents in relation to subject choices
- provide an in-depth analysis of the factors influencing the STEM subject choices of young people (14-19 years) in the UK
- consider implications from the review in terms of research, policy and practice.

Factors influencing subject choice: a map of research activity

Figure A below presents an overview of studies undertaken in OECD countries on the factors that influence young people (aged 11-19) in education, or their parents, in relation to subject choices.

Figure A: Map of research activity



Of 7235 potentially relevant citations, 240 studies were identified as meeting the criteria for inclusion in the map. The majority had a major focus on at least one STEM subject, ranging from 108 that included mathematics to seven that referred specifically to engineering. This contrasted with those investigating non-STEM subjects, of which modern foreign languages (37 studies) was the most prominent.

Pupils' views about their future (117 studies) were most frequently explored, followed by gender (107) and the school context (93). Of particular relevance to the current review, pupils' views about STEM subjects were part of over 30 per cent (88) of the studies.

This level of interest in STEM subjects in these studies reflects the particular economic interest shown in STEM and wider concerns about potential skills shortages (as noted above).

STEM subject choices of young people (14-19): in-depth review

The factors that have been considered to influence subject choice are listed below - but, with the exception of gender, ethnicity and ability, each factor was only investigated in one study and/or in lower-quality studies:

- gender
- ethnicity
- ability
- socioeconomic status
- school/college size
- school type (comprehensive/grammar/etc.)
- school type (with sixth-form/without sixth-form)
- school type (single-sex/co-educational)
- school type (independent/local authority)
- school type (religious denomination)
- grouping practices (i.e. setting by ability)
- geographical setting
- subjects taken at GCSE
- qualifications of teaching staff
- performance of school/college
- school status (degree of autonomy of school management)
- gender ratio of staff
- urbanicity.

Only 12 studies were identified as medium to high quality. The following findings are based on these studies only.

Gender: In common with two previous reviews (Pollard, 2003; Murphy and Whitelegg, 2006), the analysis showed that boys and girls tend to make different choices. The data indicate that around age 14, boys are more likely to take separate sciences than girls are, when given the choice. In contrast, girls were more likely than boys to take modern foreign languages.

Ethnicity: Although the review indicates that young people described as Asian are more likely than those from other ethnic groups to select science and/or mathematics subjects post-16, the data have to be treated with caution. The studies in question treat this category as a homogenous group, yet it encompasses people coming from different socio-cultural and ethnic backgrounds. This observation emphasises the complex nature of the problem and the significant challenges to researchers in trying to understand the main drivers of subject choice for young people.

Ability: Young people with higher levels of prior attainment are more likely than those with lower levels of prior attainment to continue their studies in science and/or mathematics subjects. This finding reinforces that of Gorard and See (2008b) in their review exploring the relationship between socioeconomic status and participation and attainment in science.

The perceived usefulness of the subject for personal reasons, such as further studies or future careers, was a major reason young people gave for their choice of subjects for post-16 study, the other main reasons being their assessment of their own ability in the subject and level of enjoyment/interest. Girls were more likely than boys to refer to interest and enjoyment as a reason, while boys were more likely than girls to talk about how easy they considered the subject to be.

Overall conclusion

The review has resulted in some interesting findings but ultimately it has raised many more questions than it answered. Without doubt, the most significant finding was the lack of good-quality research on this topic - a situation that should be addressed.

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