Student Perceptions of Geography, Earth & Environmental Sciences (GEES)

Final Report for Schools

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Introduction

Geography, earth and environmental sciences are very much in the media at present. There are a wide variety of natural history television programmes and the news regularly contains references to natural disasters, climate change and so on. However, this coverage does not seem to translate to a high demand for higher education courses in the disciplines, at least not in the same way that dramas such as Silent Witness have created a demand for forensic science courses (for example). So what are the perceptions of the disciplines? Developing an understanding of school students' attitudes to and perceptions of the GEES disciplines will help to inform HE departments' recruitment and retention strategies as well as providing an opportunity to better promote the disciplines in schools, colleges and to the public.

The Higher Education Academy Subject Centre for Geography, Earth & Environmental Sciences (GEES) aims to support and enhance learning and teaching in these three disciplines in UK HE (see http://www.gees.ac.uk). Over the last academic year (2006-2007), the GEES Subject Centre has conducted a small-scale research study in order to develop a better understanding of school students' perceptions of the three disciplines. The study included a literature review and a questionnaire-based survey of selected schools in England, Scotland, Wales and Northern Ireland.

A team of 22 colleagues from the GEES community around the UK were involved in the planning of the project and the design of the questionnaire. Schools were recruited through team members' personal contacts and a total of 946 students from 20 schools completed the questionnaire.

The study was intended to act mainly as a pilot in order to identify key areas for further, more in-depth research. The resourcing of the project was such that, although common questionnaire and teacher-guidelines were sent to all participating schools, it was not possible for a team member to attend each questionnaire-completion session. It cannot be guaranteed, therefore, that the conditions were the same in each school. However, the commonality of responses across the schools suggests that data are valid, reliable and generalisable.

This report provides a discussion of the key findings from the survey in the context of recruitment into the GEES disciplines at HE and the wider literature on student perceptions and subject choice. Some suggestions for applications of this data and recommendations for further research are also offered.

I would like to offer my thanks to the colleagues, school teachers and students who gave their time to this project, in particular to Sian Evans for her assistance in the data analysis. A list of team members is provided in Appendix A; the schools have been anonymised to preserve confidentiality.

Methodology

In September 2006, a draft version of the questionnaire was piloted with schools from south Wales. Ten schools were involved and the questionnaire was completed (under teacher supervision) by students from years 7, 10 and 12. As well as offering a chance to trial the questionnaire, this pilot study provided an opportunity to compare responses across a range of school years. Following this pilot, the questionnaire was revised slightly and then circulated to a further ten schools for use with Year 12 only.

1: Influence on A Level Choice

The Year 12 students (664 from 13 different schools in the pilot and final survey) were asked to rank various factors according to how much an influence they had had on their choice of A level subjects.

The responses were generally consistent across all the schools with the following factors consistently been selected as 'Very Important' or 'Important':

- My interest in the subject;
- My future career or job;
- My enjoyment of the subject;
- What I want to study at university.

''How well I did in GCSEs' and 'How much money I can earn in my career' received a relatively high rating when averaged across all the schools but there was a greater spread of responses between schools than for the above four factors (figure 1.1).

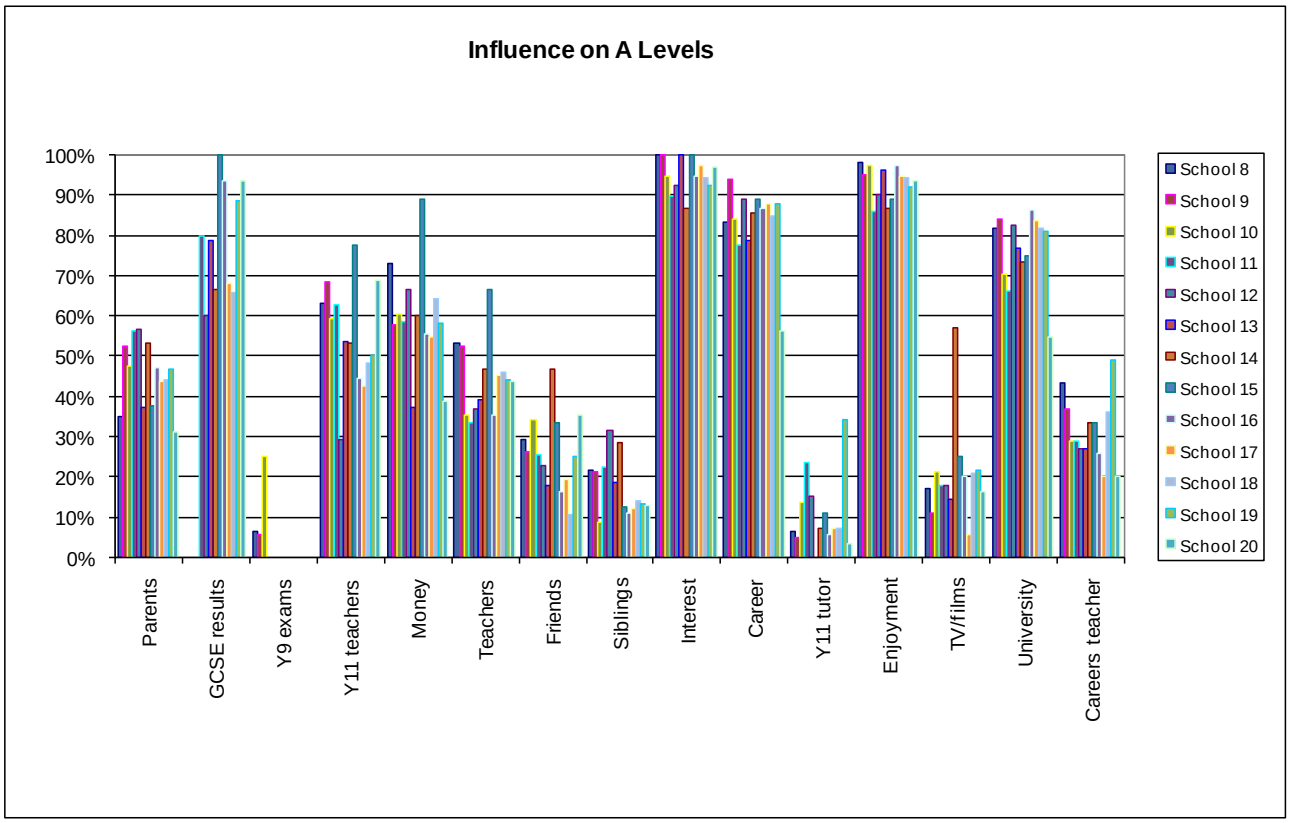


Fig 1.1: Percentage of respondents from each school (*not* including those who responded 'don't know') who indicated that a factor was 'Very Important' or 'Important'. NB The influence of Year 9 exams was only included in the pilot questionnaire and the influence of GCSE results was only included in the final version.

Gender Differences

The total data for all the schools were analysed for differences in responses between males and females (Figure 1.2):

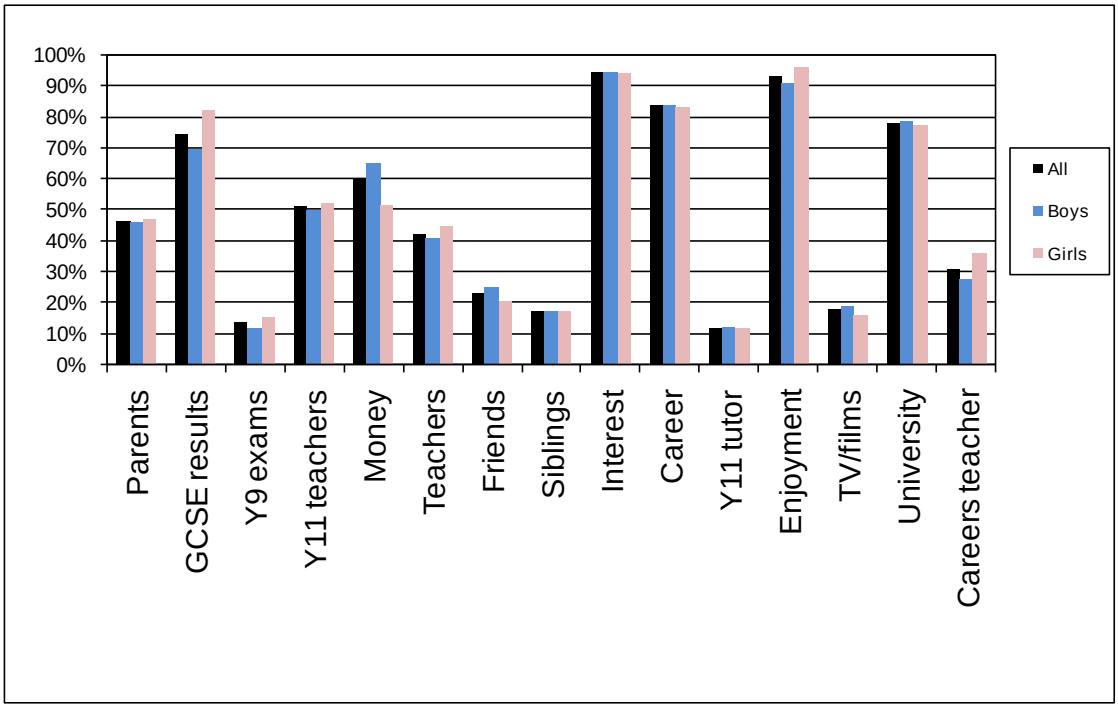


Fig 1.2: Percentage of all respondents (*not* including those who responded 'don't know') who indicated that a factor was 'Very Important' or 'Important'. All respondents are in the left column of each group, girls in the middle and boys to the right.

Statistically significant differences in responses between boys and girls were found for the following factors (using the Chi-squared test):

- How well I did in GCSEs (more girls than boys indicated that this was 'Very Important' or 'Important': 1% confidence level);
- How much money I can earn in my career (more boys than girls indicated that this was 'Very Important' or 'Important': 1% confidence level);
- My enjoyment of the subject (more girls than boys indicated that this was 'Very Important' or 'Important': 5% confidence level).

Discussion

The main influences of GCSE results, Interest, Career, Enjoyment and University found here reflect the findings of other research studies into student choice at GCSE and 17+ levels (e.g. Ashworth & Evans, 2001; Garratt, 1985; Weeden, 2007;Rolfe, 2001: see literature review in Appendix B for full references).

However, it is important to note that these results soley reflect the students' own perceptions of the influences on their choice of A level subjects. In reality, the situation is much more complex. According to our literature review there is no doubt that schools and teachers have an important influence on students' perceptions of GEES subjects and on education choices at 14+, 16+ years and beyond, but the nature and timing of this influence are very subtle, as many authors comment. Furthermore, the influences of schools and teachers take at least two forms; the visible and explicit advice and guidance given to students at specific times and; the pervasive, subtle and continuous influence through conveyed expectations, examples and norms, part of the well-documented "hidden curriculum". This second category of influence can be represented as an 'expectation framework', often surrounding the student since birth, within which students make their educational choices. Also, practices in schools can affect the ways in which gender, social class and ethnicity influence subject choice (Stables, 1996).

Right from the start it is important to note that "school was less of an important source of advice than parents or home-related influences for pupils likely to pursue academic post-16 pathways" (Foskett *et al.*, 2004, p.2). Schools influence children's perceptions throughout their school lives and much research indicates that this ongoing influence is more significant for HE choice than the more immediate and visible influences of careers and HE guidance at 16+ and 17+ years. In addition, attainment prior to 16

years probably has a greater influence on degree subject choice than attainment and attitudes developed through the A Level years:

> *"It is this cumulative process of evolving perception and achievement that has the real effect on degree subject choice: and for most people that starts well before the age of 14 years."* Roger Trend, Literature Review

General agreement with the literature is an encouraging outcome for this part of the questionnaire and this, together with the overall similarity of responses between the different schools, suggests that the data (both for this question and other aspects of the survey) are valid, reliable and generalisable.

2: Perceptions of Geography, Geology and Environmental Sciences

If it is true that students' choice of HE subject is the result of a cumulative process of perception and attainment then it is important that 'marketing' activities start at a young age, particularly as school students are now able to opt out of studying Geography for GCSE and Geology and Environmental Sciences are rarely taught as separate subjects.

Weeden (2007) and Biddulph and Adey (2004) note the influence of enjoyment and relevance on GCSE choices. Although two-thirds of KS3 students perceived geography as being generally 'useful', many found it difficult to identify any real purpose for studying it. When it comes to pupils' GCSE choices of geography, it seems that both enjoyment and relevance have to figure large in their perceptions if they are to choose that subject; enjoyment alone is insufficient to trigger selection.

If the GEES community is to effectively market the disciplines through its various contacts and interventions with schools (including individual HE institutions and professional bodies), then it must have a good understanding of school students' current perceptions of the disciplines in order to a) dispel any misconceptions and b) speak to the students in their own language.

This section of the project report provides an overview of the findings from the questionnaire where students were asked to provide a free text answer to the following questions:

- Geography: what do you think this is all about?
- Geology: what do you think this is all about?
- Environmental Science: what do you think this is all about?

Section three looks at the inferences to be made from schools students' career aspirations in comparison to the jobs they think are available to geographers, geologists and environmental scientists.

It is important to note that the responses were obtained through a written questionnaire that was not overseen by a researcher (though teachers were provided with guidelines for administration of the questionnaire). The responses are likely to be the school students' immediate thoughts on the subjects and may not represent fully considered opinions. In addition, differences in writing ability / speed may also have affected the range of responses. The data should be, therefore, considered as 'food for thought' and to provide indicators for further, more rigorous research rather than as definitive descriptors of the students' understandings of the subjects.

The two-fold nature of the study (the pilot and final version) allows different comparisons to be made with the data. Firstly, the change in perceptions from Year 7 through to Year 12 can be studied from the pilot data and, secondly, the difference in perceptions between students studying A level Geography or Geology and those not can be looked at from the rest of the data.

It should be noted that the term 'Geology' was used rather than 'Earth Science' or 'Geoscience' as this is the title of GCSE and A Level courses. It was considered that students would be less familiar with the latter two terms. For this part of the GEES community, it would be interesting to explore these concepts further to ascertain the best terminology to use when marketing the subject. Although academics may be able identify a distinction between the three terms, there is probably a subtly that might be lost on school students. Indeed it could be conjectured that the Geological Society's 'Careers in Geoscience' publication may not be attractive to students browsing through careers libraries as they are simply not familiar with the term. (NB The comments in this paragraph are purely the thoughts of the researcher, herself a geology graduate).

2.1: Changing Perceptions from Year 7 to Year 12

The following section provides an analysis of school students' perceptions of the three disciplines at Year 7 (11 year old +), Year 10 (14+) and Year 12 (16+) with the data being taken from responses to the pilot questionnaire. Ten schools in Wales were involved as follows:

- Year 7: four schools, 165 students in total;
- Year 10: three schools, 117 students;
- Year 12: three schools, 110 students.

Again, the similarity of responses to other questions with schools from England and Scotland suggest that these findings are likely to be generalisable. It should be noted, however, that no inference can be made on the development of perceptions from Year 7 to Year 12 as different students and schools were involved in each case. Longitudinal research would be required in order to ascertain how perceptions change over time.

As with all qualitative analyses there is a certain amount of subjectivity in the categorization of the responses. The data were analysed by a single researcher (the author) with mind to other conceptions studies (in particular the current study of undergraduate conceptions of the disciplines being undertaken by the Experiential Learning Centre for Excellence at the University of Plymouth).

Geography: what do you think this is all about?

Year 7:

- 10% of the 165 respondents either didn't know or provided no response.
- 37% stated that it was about the world or the earth;
- 29% mentioned maps;
- 22% mentioned places (e.g. countries, towns and cities);
- 28% mentioned physical features (e.g. rivers, environment);
- 7% mentioned weather;
- 7% mentioned people;
- 7% mentioned both physical and human aspects but only 1 student mentioned physical-human interactions;
- 5% mentioned issues such as natural hazards and global warming; and
- 7% mentioned processes such as 'what happens around us'.

Only one student mentioned physical-human interactions and only one mentioned a sense of people and places (areal differentiation). There was no mention of geography being about spatial or temporal patterns. The full data are provided in table 2.1 below.

Typical responses included:

Geography is about maps houses and land

I think it is about studying the world

I think it is all about maps & weather. Learning about countrys [sic]

maps the enviroment [sic] and how people live

Geography is about what is around like the contry side [sic] and city

	Don't Know / No Response	The world	Maps	Places	Physical Environment	Weather	People	Physical & Human	Issues	Processes
School 1	8%	28%	30%	28%	18%	5%	5%	8%	3%	5%
School 2	7%	44%	33%	26%	30%	22%	0%	7%	4%	19%
School 3	20%	32%	36%	12%	24%	0%	0%	0%	8%	2%
School 4	4%	45%	18%	27%	39%	8%	20%	12%	4%	6%
Total	**10%**	**37%**	**29%**	**22%**	**28%**	**7%**	**7%**	**7%**	**5%**	**7%**

Table 2.1: Percentage of Year 7 respondents who mentioned each of the selected categories. Note that individual responses may fall into more than one category. There is a clear variation between different schools suggesting a strong influence from the teacher or classroom environment (e.g. posters).

Year 10:

- 26% of the 117 respondents either didn't know or provided no response (although ¾ of these were from one school).
- 51% stated that it was about the world or the earth;
- 5% mentioned maps;
- 4% mentioned places (e.g. countries, towns and cities);
- 28% mentioned physical features (e.g. rivers, environment);
- 9% mentioned weather;
- 16% mentioned people;
- 14% mentioned both physical and human aspects;
- 11% mentioned issues such as natural hazards and global warming;
- 17% mentioned processes such as 'what happens around us'; and
- 4% mentioned people and places (e.g. 'people in different places').

Only one student mentioned physical-human interactions and there was no mention of geography being about spatial or temporal patterns. There was a considerable difference in the types of responses from the three schools. School 5's responses tended to be longer and more in depth than those of School 7, and only 11 of the 37 students from school 6 provided a response.

The full data are provided in table 2.2 below.

Typical responses included:

I think that geography is about the world e.g. population, planets, rocks the sea and the weather. It is also split into human, physical and environment

is about the world and the natural hazards and causes of how the earth become this way and how people live and move on earth

study of climate and the physical features of the earth

I think its all about the study of the world and how it works

The world. Weather. People in different places

	Don't Know / No Response	The world	Maps	Places	Physical Environment	Weather	People	Physical & Human	Issues	Processes	People & places
School 5	0%	56%	0%	10%	39%	10%	41%	39%	29%	20%	10%
School 6	70%	22%	3%	0%	8%	3%	0%	0%	3%	3%	0%
School 7	10%	71%	12%	2%	34%	12%	5%	0%	0%	27%	2%
Total	**26%**	**51%**	**5%**	**4%**	**28%**	**9%**	**16%**	**14%**	**11%**	**17%**	**4%**

Table 2.2: Percentage of Year 10 respondents who mentioned each of the selected categories. Note that individual responses may fall into more than one category. There is a clear variation between different schools suggesting a strong influence from the teacher or classroom environment (e.g. posters).

Year 12:

- 12% of the 110 respondents either didn't know or provided no response.
- 55% stated that it was about the world or the earth;
- 1% mentioned maps;
- 7% mentioned places (e.g. countries, towns and cities);
- 50% mentioned physical features (e.g. rivers, environment);
- 5% mentioned weather;
- 29% mentioned people;
- 26% mentioned both physical and human aspects;
- 4% mentioned issues such as natural hazards and global warming;
- 21% mentioned processes such as 'what happens around us';
- 5% mentioned people and places (e.g. 'people in different places');
- 7% mentioned physical-human interactions; and
- 4% mentioned spatial patterns.

There was no mention of geography being about temporal patterns. The full data are provided in table 2.3 below.

Typical responses included:

The study of the physical and human processes of the earth

Places; the reasons & findings of population & the differences in countries

The study of the earth - natural issues, people in the environment and how they affect each other

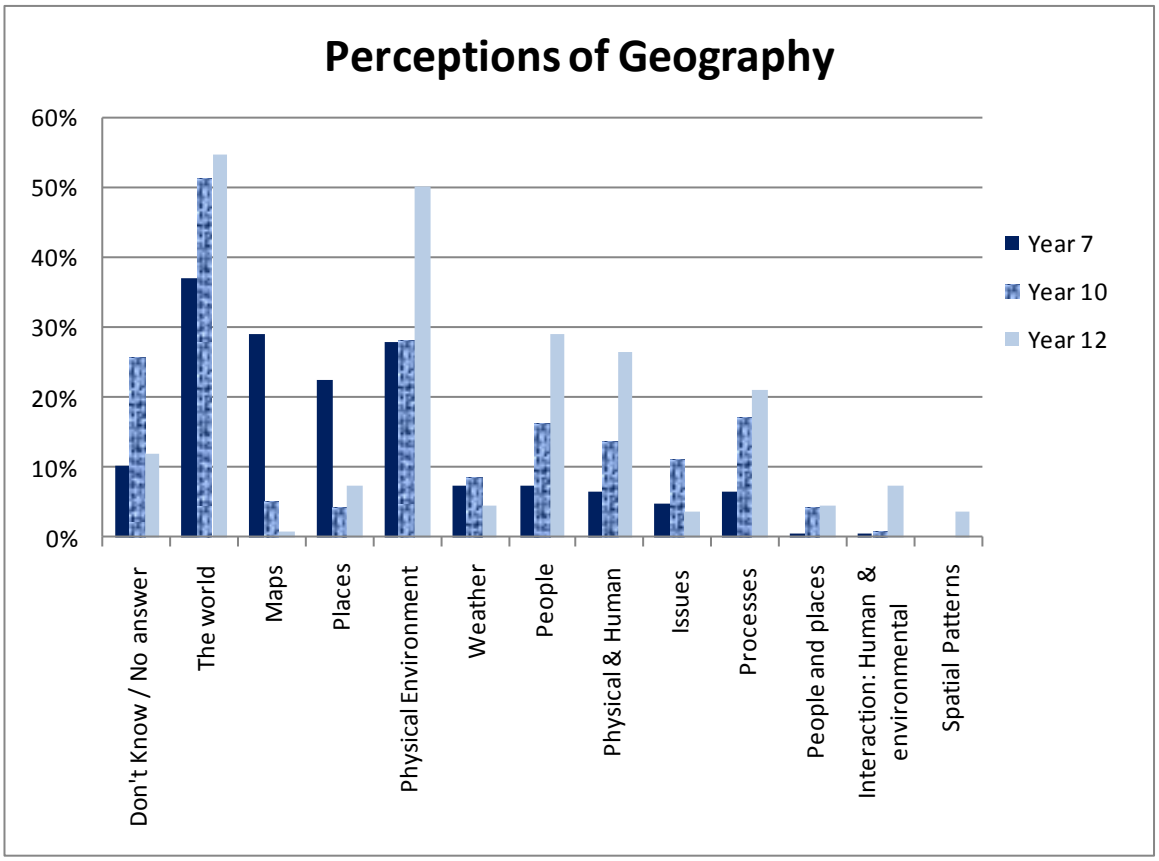
Learning about different places of the world

	Don't Know / No response	The world	Maps	Places	Physical Environment	Weather	People	Physical & Human	Issues	Processes	People and places	Interaction: Human & physical	Spatial Patterns
School 8	2%	50%	0%	4%	54%	6%	50%	44%	2%	30%	6%	14%	0%
School 9	25%	50%	0%	5%	50%	0%	25%	25%	0%	25%	0%	0%	0%
School 10	18%	63%	3%	13%	45%	5%	5%	5%	8%	8%	5%	3%	10%
Total	**12%**	**55%**	**1%**	**7%**	**50%**	**5%**	**29%**	**26%**	**4%**	**21%**	**5%**	**7%**	**4%**

Table 2.3: Percentage of Year 12 respondents who mentioned each of the selected categories. Note that individual responses may fall into more than one category. Interestingly, the variations in responses between schools is less distinct than for previous years.

Perceptions of Geography: Comparison of Year 7, 10 & 12

The data suggest that students' perceptions of geography do develop throughout secondary school becoming broader and more sophisticated, e.g. moving away from the study of maps to being more about processes and interactions. However, the data also illustrate that variations between students in the same year at different schools may be just as great as the difference between year groups.



Geology: what do you think this is all about?

Year 7:

- 61% of the 165 respondents either didn't know or provided no response.
- 20% stated that it was about rocks;
- 8% mentioned volcanoes;
- 4% mentioned the solar system;
- 3% stated that it was about the Earth or world; and
- 2% mentioned earthquakes.

Only one student mentioned earth processes and there was no mention of fossils, Earth through time or Earth systems. The full data are provided in table 2.4 below.

	Don't Know / No Response	**Rocks**	**Volcanoes**	**Solar System**	**Earth**	**Earth quakes**	**Maps**
School 1	27%	51%	2%	7%	2%	0%	5%
School 2	77%	12%	0%	0%	8%	0%	0%
School 3	69%	19%	21%	0%	0%	4%	0%
School 4	75%	0%	6%	6%	4%	2%	2%
Total	**61%**	**20%**	**8%**	**4%**	**3%**	**2%**	**2%**

Table 2.4: Percentage of Year 7 respondents who mentioned each of the selected categories. Note that individual responses may fall into more than one category. There is a clear variation between different schools in all categories except 'rocks' where the response is more consistent.

Typical responses included:

Rocks

Studying rocks

Rocks and volcanoes

Year 10:

- 55% of the 117 respondents either didn't know or provided no response (although ~ half of these were from the same school that provided a low response to the geography question).:
- 36% stated that it was about rocks;
- 2% mentioned the solar system;
- 4% stated that it was about the Earth or world;
- 3% mentioned earth processes;
- 2% mentioned humans; and
- 2% mentioned fossils.

There was no mention of volcanoes, earthquakes, maps, Earth through time or Earth systems. The full data are provided in table 2.5 below.

Typical responses included:

Geology is about studying rocks

Rocks

	Don't Know / No Response	**Rocks**	**Solar System**	**Earth**	**Earth Processes**	**Humans**	**Fossils**
School 5	41%	39%	5%	5%	2%	5%	5%
School 6	83%	11%	0%	3%	0%	0%	0%
School 7	44%	54%	0%	5%	5%	0%	0%
Total	**55%**	**36%**	**2%**	**4%**	**3%**	**2%**	**2%**

Table 2.5: Percentage of Year 10 respondents who mentioned each of the selected categories. Note that individual responses may fall into more than one category. There is a clear variation between different schools in all categories except 'rocks' where the response is more consistent.

Year 12:

- 23% of the 110 respondents either didn't know or provided no response.
- 57% stated that it was about rocks;
- 1% mentioned volcanoes;
- 15% stated that it was about the Earth or world;
- 8% mentioned earth processes; and
- 5% mentioned fossils.

There was no mention of earthquakes, maps, Earth through time or Earth systems. The full data are provided in table 2.6 below.

Typical responses included:

Rocks

Studying rocks

A good response stated that geology was:

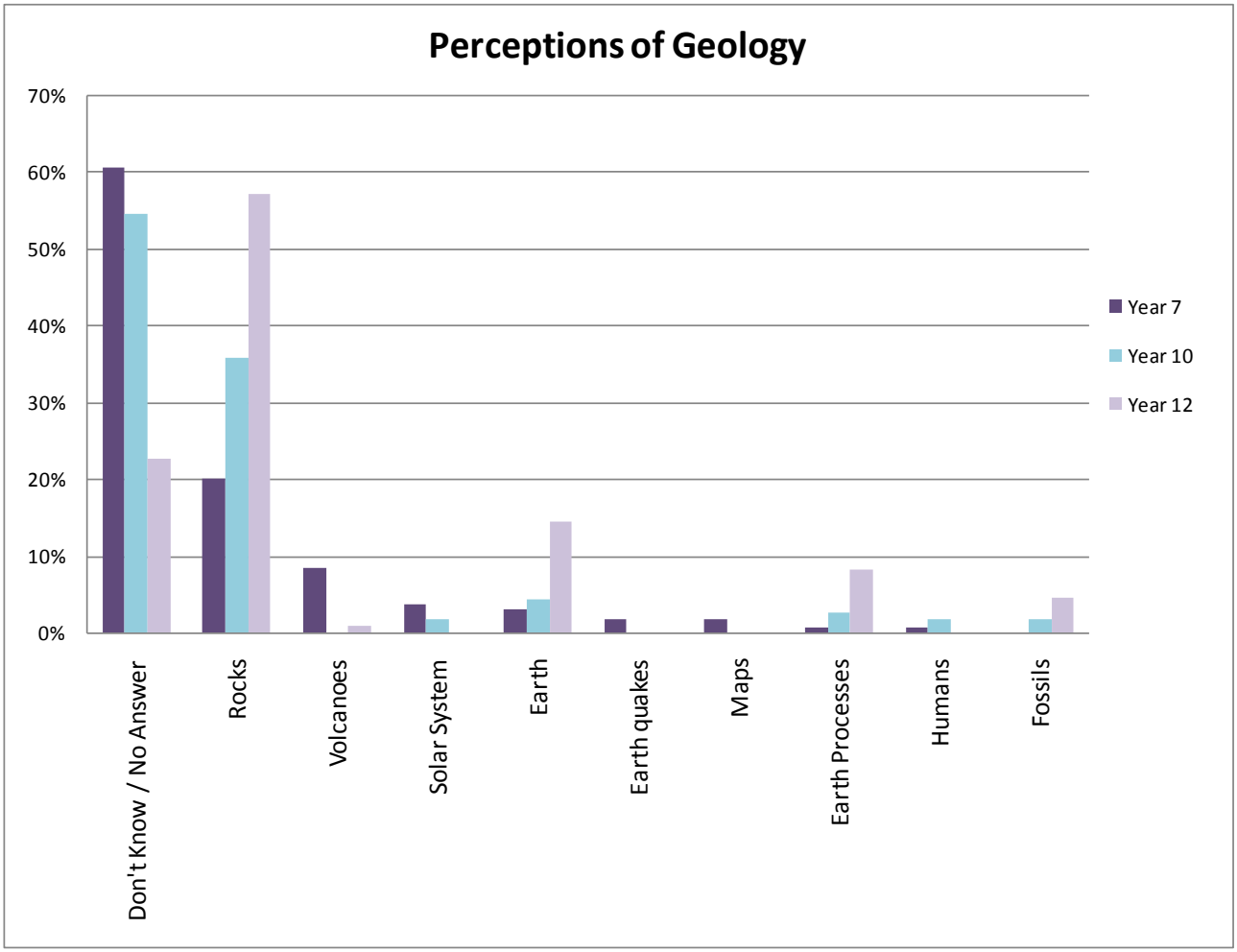
The study of rocks mineral that make up the world and how the earth is made and proceses [sic] in the earth

	Don't Know / No response	**Rocks**	**Volcanoes**	**Earth**	**Earth quakes**	**Earth Processes**	**Fossils**
School 8	6%	74%	0%	16%	0%	14%	2%
School 9	60%	5%	0%	15%	0%	10%	0%
School 10	25%	63%	3%	13%	0%	0%	10%
Total	**23%**	**57%**	**1%**	**15%**	**0%**	**8%**	**5%**

Table 2.6: Percentage of Year 12 respondents who mentioned each of the selected categories. Note that individual responses may fall into more than one category. There is a clear variation between different schools in all categories.

Perceptions of Geology: Comparison of Year 7, 10 & 12

The data suggest that students' understanding of geology does not develop significantly through secondary school and what they do express is limited to 'rocks'. There is no apparent sense of the temporal depth of geology and very little of the commonly thought of 'exciting' topics of volcanoes, earthquakes and fossils (or dinosaurs).



Environmental Science: what do you think this is all about?

Year 7:

- 34% of the 165 respondents either didn't know or provided no response.
- 21% stated that it was about the environment;
- 13% mentioned wildlife or nature;
- 10% mentioned pollution;
- 7% mentioned care of the environment;
- 5% mentioned issues such as global warming;
- 5% mentioned chemicals;
- 3% mentioned an interaction between people and the planet;
- 3% though it was to do with health & safety;
- 3% mentioned science;
- 2% mentioned natural hazards (volcanoes and earthquakes);
- 2% mentioned the weather; and
- 2% mentioned Earth processes.

The full data are provided in table 2.7 below. Typical responses included:

I think its about pollution and how things affect us

Its all about the environment and habitats animals and people

It is about the environment

Looking after the Enviroment [sic]

	Don't Know / No Response	Environment	Nature	Pollution	Care of Environment	Issues	Chemicals	People / Earth Interaction	Health & Safety	Science	Natural Hazards	Weather	Processes
School 1	18%	23%	13%	23%	8%	5%	8%	3%	0%	3%	5%	3%	3%
School 2	48%	11%	7%	4%	11%	4%	4%	4%	11%	7%	0%	4%	0%
School 3	44%	20%	12%	6%	2%	8%	0%	0%	0%	2%	0%	0%	0%
School 4	29%	27%	18%	6%	8%	4%	8%	6%	4%	2%	4%	2%	4%
Total	**34%**	**21%**	**13%**	**10%**	**7%**	**5%**	**5%**	**3%**	**3%**	**3%**	**2%**	**2%**	**2%**

Table 2.7: Percentage of Year 7 respondents who mentioned each of the selected categories. Note that individual responses may fall into more than one category.

Year 10:

- 42% of the 117 respondents either didn't know or provided no response.
- 26% stated that it was about the environment;
- 10% mentioned wildlife or nature;
- 3% mentioned pollution;
- 4% mentioned issues such as global warming;
- 1% mentioned an interaction between people and the planet;
- 3% mentioned science;
- 3% mentioned natural hazards (volcanoes and earthquakes);
- 2% mentioned the weather;
- 9% mentioned Earth processes; and
- 9% stated it was to do with science and the environment.

There was no mention of care for the environment / planet. The full data are provided in table 2.8 below. Typical responses included:

Its about science and environment around us

Studying the environment and the problems it faces

The environment

	Don't Know / No Response	Environment	Nature	Pollution	Issues	People / Earth Interaction	Science	Natural Hazards	Weather	Processes	Science & Environment
School 5	10%	34%	20%	7%	7%	2%	7%	7%	5%	10%	17%
School 6	83%	6%	9%	0%	0%	0%	0%	0%	0%	0%	3%
School 7	39%	37%	2%	2%	5%	0%	2%	0%	0%	17%	5%
Total	**42%**	**26%**	**10%**	**3%**	**4%**	**1%**	**3%**	**3%**	**2%**	**9%**	**9%**

Table 2.8: Percentage of Year 10 respondents who mentioned each of the selected categories. Note that individual responses may fall into more than one category.

Year 12:

- 33% of the 110 respondents either didn't know or provided no response.
- 25% stated that it was about the environment;
- 2% mentioned wildlife or nature;
- 2% mentioned pollution;
- 3% mentioned care of the environment;
- 3% mentioned issues such as global warming;
- 2% mentioned an interaction between people and the planet;
- 5% mentioned science;
- 2% mentioned natural hazards (volcanoes and earthquakes);
- 7% mentioned Earth processes; and
- 23% stated it was to do with science and the environment.

The full data are provided in table 2.9 below. Typical responses included:

The science of the environment

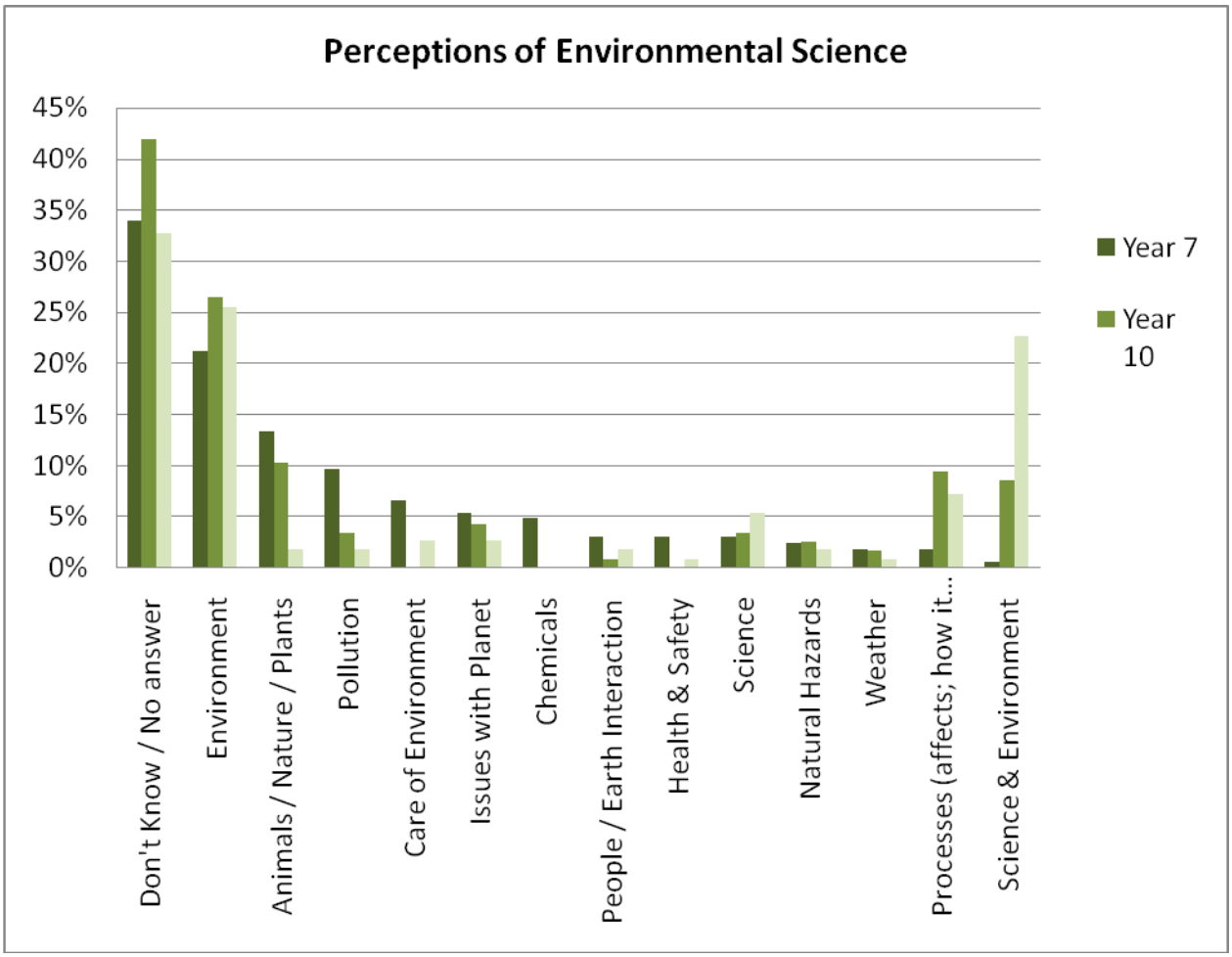
The study of the environment

Environment

	Don't Know / No Response	Environment	Nature	Pollution	Care of the Environment	Issues	People / Earth Interaction	Science	Natural Hazards	Processes	Science & Environment
School 8	32%	20%	4%	4%	4%	2%	2%	4%	0%	2%	32%
School 9	40%	20%	0%	0%	0%	0%	0%	20%	10%	10%	15%
School 10	30%	35%	0%	0%	3%	5%	3%	0%	0%	13%	15%
Total	**33%**	**25%**	**2%**	**2%**	**3%**	**3%**	**2%**	**5%**	**2%**	**7%**	**23%**

Table 2.9: Percentage of Year 12 respondents who mentioned each of the selected categories. Note that individual responses may fall into more than one category.

Perceptions of Environmental Sciences: Comparison of Year 7, 10 & 12
Interestingly, the data suggests that students' perceptions of environmental science become less sophisticated as they progress through secondary school. More imaginative responses were provided by the Year 7 students than those in Year 10 or 12.



Years 7-12 Perceptions of GEES: Discussion

The data from the pilot questionnaires raised some interesting issues. It has already been noted that care should be taken in reading too much into the findings due to the use of different schools across and within the year groups and the subjectivity of the categorisation. However, some generalities can be made which offer some food for thought.

The percentage of 'Don't Know' or no responses varies between the disciplines. This cannot necessarily be taken to mean a lack of knowledge of understanding about the subjects (the students simply might have not bothered to answer); however, it is interesting that the 'Don't Know' response was more frequent against the Geology (61%, 25% and 23% in Years 7, 10 and 12 respectively) and Environmental Science questions (34%, 42% and 33%) than for Geography (10%, 25% and 12%). This is perhaps unsurprising given that Geography has a named place in the National Curriculum for all students whereas the other disciplines tend to be 'hidden' within Geography or other subjects.

Catling (2001) looked children's perceptions at the end Key Stage 2 (age 11 years). Noting that 15% of them could provide no definition of geography at all. Most children express their perceptions in terms of mapwork, the world and countries. In general they "have a narrower image of the subject than some geographers might contend is accurate". Catling goes on to suggest that these KS2 perceptions of geography reflect the general public perception of the subject. A small pilot research study conducted by Geography students from the University of Plymouth (on work-placement with the GEES Subject Centre

and Experiential Learning CETL) looked into the public perceptions of the three disciplines. The research suggested that the general public seem to have a broader, more sophisticated view of the disciplines than do school children of any age; this was particularly notable for geology and may be to do with adults' exposure to Earth-based issues and information in the media and /or experience in further or higher education.

For each of the disciplines, the concept of human and physical *interactions* features in only a limited number of responses. This finding is reflected in research conducted by Paul Wright at Southampton Solent University with undergraduate geography students who investigated their conceptions of the discipline in relation to a particular topic: climate change. He found that "Student conceptions still do not recognise the acclaimed integrative nature of the subject".

A full textual analysis (including word counts, use of adjectives, phrases etc.) was not undertaken. The data were simply categorised according to the words used. However, an overview suggests that the number of words used by the students to describe each subject decreased from geography to environmental sciences to geology respectively. The students tended to use fuller sentences when writing about geography compared with single words when describing geology. It could be inferred that this might be due to their enhanced understanding of geography due to its named place in the national curriculum; some imaginative / informed guesswork around environmental sciences; and a stereotypical perception of geology. Whatever the cause, it is clear that some work is required, in different ways for each subject perhaps, to enhance school students perceptions of GEES.

2.2 A Comparison of the Perceptions of the GEES Disciplines between those Year 12 Students Studying Geography / Geology and those not.

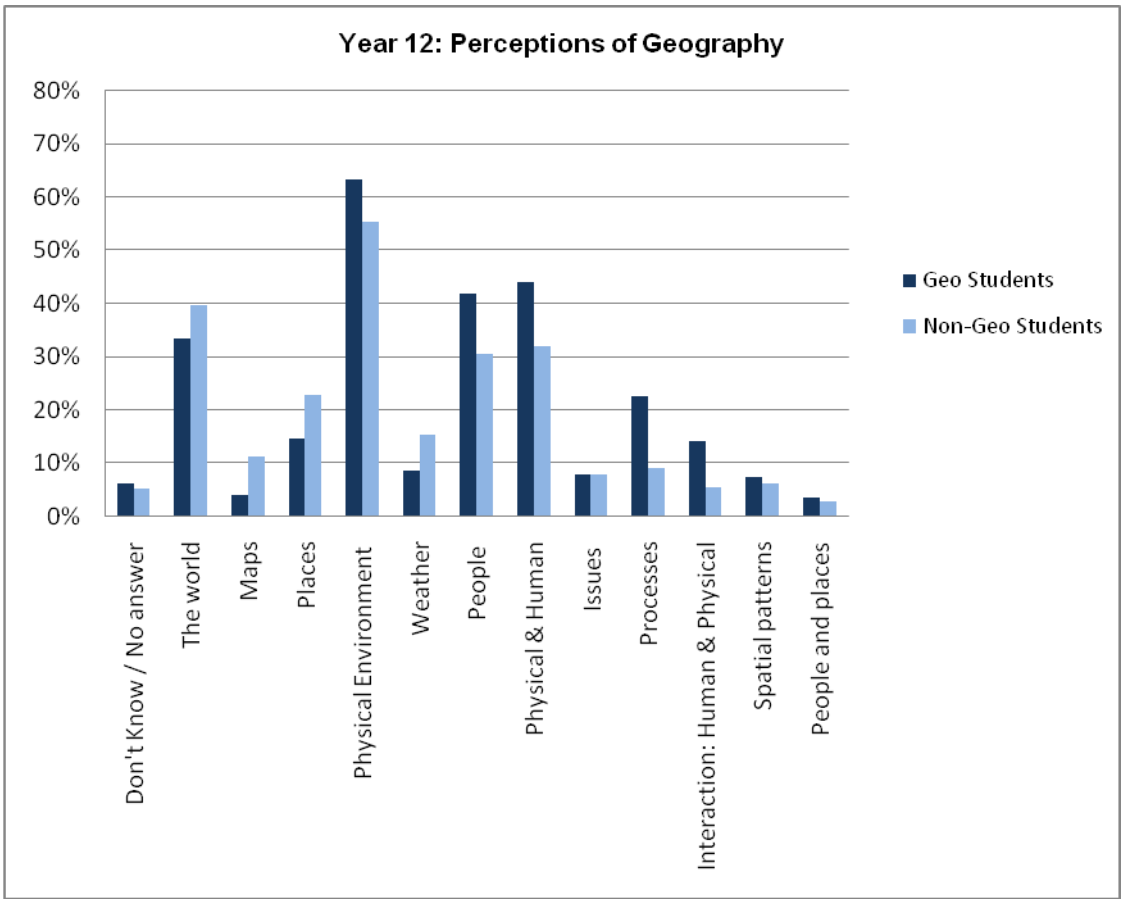
In addition to the ten schools surveyed in the pilot phase of this project, a further ten schools were sent the final version of the questionnaire for use with their Year 12 students. These data were amalgamated and then separated according to whether the student was studying geography / geology at A level ('Geo' students) or not ('Non-Geo). 6 students did not provide any responses to any questions so were not included in the data analysis.

- Geography Students: 158
- Geography & Geology Students: 9
- Geology Students: 10
- Other: 371
- Total respondents: 548

Geography: what is this all about?

6% of the 177 Geo students and 5% of the 371 non-Geo students failed to provide an answer. The data for those who did respond (as a percentage of the whole 177) are provided in the table and figure below:

	The world	Maps	Places	Physical Environment	Weather	People	Physical & Human	Issues	Processes	Interaction: Human & Physical	Spatial patterns	People & places
Geo	33%	4%	15%	63%	8%	42%	44%	8%	23%	14%	7%	3%
Non-Geo	40%	11%	23%	55%	15%	30%	32%	8%	9%	5%	6%	3%



These responses follow the same general pattern as found in the pilot survey with responses falling mostly within the categories ‘the world’, ‘physical environment’, ‘people’, ‘physical and human’ and ‘processes’. However, there does seem to be a clear difference between Geo and non-Geo students’ responses. Geography / geology students tend to have a deeper understanding of the discipline being more aware of the physical and human dimensions as well as the interactions between them and having less emphasis on basic responses such as ‘the world’ or ‘maps’. However, only 1 Geo-student and 2 non-Geo students made reference to changes over time.

Typical responses included:

Geo Students

The study of natural processes, environment in accordance to the earth as well as human activity such as urbanisation in settlements etc

The earth, countries, physical geography, human geography, weather + climate, rivers

Land, world around us. How it is and has been affected by nature and human activity. How we can help or protect it. Trying to understand the world more.

Non-Geo Students

Weather, rocks, population, rivers, water cycle, maps

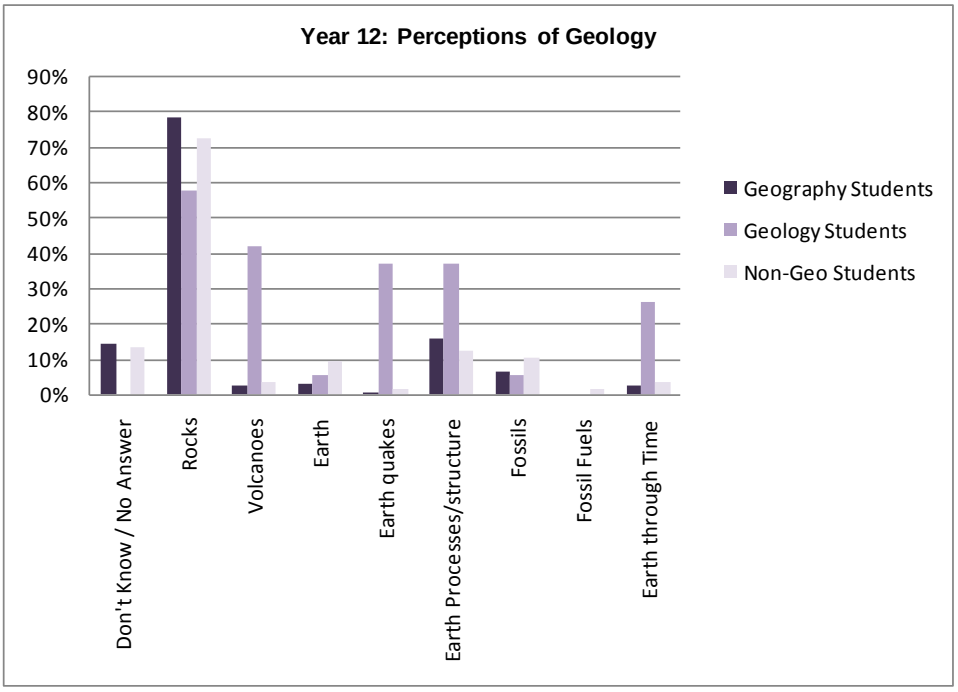
The world and people that live there.

A number of things, The world around us, landscapes and facts about the world. Learning about cultures & countries and global warming etc

Geology: what is this all about?

15% of geography and 13% of non-Geo students failed to provide a response (though all 19 students studying Geology A level responded). The data for those who did respond as a percentage of the total respondents are provided in the table and figure below:

	Rocks	Volcanoes	Earth	Earth quakes	Earth Processes /structure	Fossils	Fossil Fuels	Earth through Time
Geography	78%	3%	3%	1%	16%	6%	0%	3%
Geology	58%	42%	5%	37%	37%	5%	0%	26%
Non-Geo	73%	3%	9%	2%	12%	10%	1%	3%



These responses follow the same general pattern as found in the pilot survey with responses falling mostly within the category 'Rocks'. The Geology students seem to have a broader understanding of the subject compared to others, however, the responses are still somewhat disappointing in their lack of depth.

Typical responses included:

Geo-Students

Study of rocks

Studying different rock types and formations

Studying more physical aspects of geography, earth, rocks, etc…

Geology Students

Structure of the Earth and how things are formed

Rocks, Earthquakes + volcanoes, Natural hazards

Physical geography. The history of the earth. How the earth was and is formed. How rocks are made up

Non-Geo Students

You do this in geography. The study of rocks

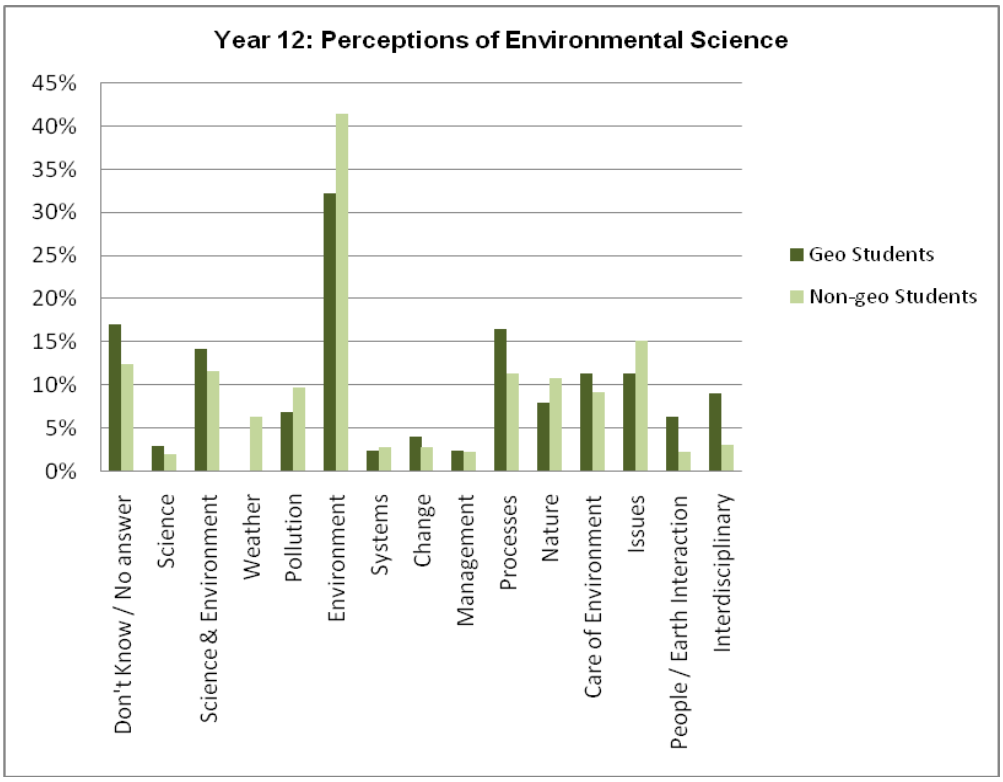
Rocks, mountains, erosion etc

Rocks, volcanoes, earthquakes, past earth history

Environmental Science: what do you think this is all about?

17% of Geo students and 12% of non-Geo students failed to provide an answer. The data for those who did respond are provided in the table and figure below:

	Science	Science & Environment	Weather	Pollution	Environment	Systems	Change	Management	Processes	Nature	Care of Environment	Issues	People / Earth Interaction	Interdisciplinary
Geo	3%	14%	0%	7%	32%	2%	4%	2%	16%	8%	11%	11%	6%	9%
Non-Geo	2%	12%	6%	10%	42%	3%	3%	2%	11%	11%	9%	15%	2%	3%



These responses follow the same general pattern as found in the pilot survey with responses falling mostly within the categories 'Environment', 'Issues', 'Processes' and 'Science and Environment'. Interestingly, the additional categories of 'Systems', 'Change', environmental 'Management' and 'Interdisciplinary' also emerged.

Typical responses included:

> *Study of human effets [sic] on the environment, how other animals and ecosystems work around us*
>
> *Studying the environment, food chains, changes caused by global warming, plants etc*
>
> *Science about the environment*
>
> *Biology and it's links with geography and the environment - evolutionary processes etc*
>
> *Studying nature and pollution within the environment*
>
> *To be honest , I don't really know I think: pretection [sic] of the environment, species which are in danger*

The last quote suggests that the term 'environment' evokes people to think about 'issues' and particularly those that are prominent in the media. Again, as with the pilot responses, the students seem to have used their imagination and informed guesswork to come up with a reasoned response. Indeed, when asked 'how do you know' about the subject and related careers, 67% of respondents stated that they had guessed compared with 56% for Geology and 41% for Geography.

3: Career Aspirations and GEES Career Perceptions

3.1 Career Aspirations

We asked the students to tell us what career or job they hoped to do when they eventually left school, college or university.

Year 7 Students

- 7 students (6%) offered no response.
- 64% stated a named job (vocation);
- 24% wanted to be professional sports people;
- 6% suggested a topic which interested them (e.g. 'working with others' or university); and
- 1 student wanted to run their own business.

The students named a total of 44 different jobs, those that were named by 3 or more students were:

Vocation	No. of responses	% of all responses
Teacher	14	8%
Vet	8	5%
Mechanic	6	4%
Armed Forces	6	4%
Police	5	3%
Fashion Designer	4	2%
Actor	4	2%
Technician	3	2%
Make Up / Beauty Therapist	3	2%
Lawyer	3	2%
Engineer	3	2%
Carpenter	3	2%
Architect	3	2%

Year 10 Students

- 20 students (17%) didn't know or offered no response.
- 63% stated a named job (vocation);
- 7% wanted to be professional sports people;
- 9% suggested a topic which interested them (e.g. 'something in computers'); and
- 4 students wanted to run their own business.

The students named a total of 39 different jobs, those that were named by 3 or more students were:

Vocation	No. of responses	% of all responses
Lawyer	6	5%
Teacher	5	4%
Police	5	4%
Hairdresser	4	3%
Engineer	4	3%
Doctor	3	3%
Vet	3	3%
Designer	3	3%
Childminder	3	3%
Surgeon	3	3%
Mechanic	3	3%

Year 12 Students (pilot study only)

- 26 students (24%) didn't know or offered no response.
- 67% stated a named job (vocation);
- 3% wanted to be professional sports people;
- 5% suggested a topic which interested them (e.g. 'something to do with psychology); and
- 1 student wanted to run their own business.

The students named a total of 36 different jobs, those that were named by 3 or more students were:

Vocation	No. of responses	% of all responses
Doctor	7	6%
Teacher	6	5%
Designer	5	5%
Engineer	5	5%
Physiotherapist	4	4%
Vet	3	3%
Surveying	3	3%

Year 12 Students (final study)

42 of the 177 Geo students (those studying Geography and/or Geology at A level) and 86 of the 371 non-Geo students didn't know what they wanted to do or offered no response. Of those who did know respond:

		Don't Know / No Response	Vocation	Sport	Topic	Own Business
Geo Students	No. of Responses	42	106	5	20	1
	% of Responses	24%	60%	3%	11%	1%
Non-Geo Students	No. of Responses	86	229	10	44	2
	% of Responses	23%	62%	3%	12%	0%

The jobs that were named by 3% or more students were:

Geo Students (49 different named jobs in total)				**Non-Geo Students** (75 different named jobs in total)		
Vocation	**No. of responses**	**% of all responses (142)**		**Vocation**	**No. of responses**	**% of all responses (142)**
Teacher	13	7%		Medicine	33	9%
Lawyer	9	5%		Engineer	16	4%
Police	6	3%		Lawyer	16	4%
Journalist	6	3%		Journalist	15	4%
Engineer	6	3%		Teacher	14	4%
				Business Management	7	2%
				Design	10	3%

Of the students studying Geography and/or Geology the following discipline-related vocations were named (the number of responses is provided in parentheses):

Geologist (2); Conservationist (1); Volcanologist (1); Palaeontologist (1); Ocean Scientist (1); Environmental Management (1)

3.2 Perceptions of GEES-related Careers

After asking for the student's perception of the discipline we then asked 'what jobs do you think geographers / geologists / environmental scientists do? (each asked separately).

What Jobs do Geographers do?

Year 7:

- 43 students out of 165 (26%) didn't know or offered no response.
- 42% stated that geographers studied or looked at things (e.g. maps, the world);
- 18% suggested that geographers travel or explore;
- 18% provided named jobs or vocations; and
- 3% mentioned 'saving the planet'.

The students named the following 11 different vocations (some student's responses may fall under more than one category):

Geography Vocation	No. of Responses	% of all Responses
Mapmaker	9	5%
Teacher	9	5%
Weather person	4	2%
Transport	2	1%
Architect	2	1%
Archaeologist	2	1%
Scientist	2	1%
Seismologist	1	1%
Planning	1	1%
Farmer	1	1%
Journalist	1	1%

Year 10:

- 35 students out of 117 (30%) didn't know or offered no response.
- 15% stated that geographers studied or looked at things (e.g. maps, the world);
- 14% suggested that geographers travel or explore;
- 44% provided named jobs or vocations; and
- 3% mentioned 'saving the planet'.

The students named 25 different vocations, those that were named by 3 or more students are listed below (some student's responses may fall under more than one category):

Geography Vocation	No. of Responses	% of all Responses
Teacher	31	26%
Meteorologist / weather person	19	16%
Tourist Guide	9	8%
Surveyor	7	6%
Cartographer / map maker	6	5%
Transport	4	3%
Marketing	4	3%
Geologist	3	3%
Ecologist	3	3%
Architect	3	3%

Year 12 (pilots only):

- 26 out of 110 (24%) students didn't know or offered no response.
- 25% stated that geographers studied or looked at things (e.g. maps, the world);
- 10% suggested that geographers travel or explore;
- 41% provided named jobs or vocations; and
- 3% mentioned 'saving the planet'.

The students named the following 15 different vocations (some student's responses may fall under more than one category):

Geography Vocation	No. of Responses	% of all Responses
Teacher	30	27%
Meteorologist / weather person	12	11%
Surveyor	4	4%
Cartographer / map maker	4	4%
Volcanologist	2	2%
Environmentalist	2	2%
Scientist	2	2%
Engineer	2	2%
Planning	2	2%
Archaeologist	2	2%
Geologist	2	2%
Geographer	1	1%
Biologist	1	1%
Business Management	1	1%
Journalist	1	1%

Year 12: Geography / Geology and non-Geo Students: 17 (10%) Geo and 51 (14%) non-Geo students didn't know or offered no response.

	Study / Research / Look for	Travel / Explore	Vocational	Save the Planet
Geo Student	37%	5%	64%	0%
Non-Geo Students	35%	5%	47%	1%

A total of 50 different named vocations were offered (Geo students identified 37 and non-Geo students, 40). Those that were named by 3% or more students are listed below (some student's responses may fall under more than one category):

	Geography / Geology Students			Non-Geo Students	
Geography Vocation	No. of Responses	% of all Responses		No. of Responses	% of all Responses
Teacher	69	39%		87	23%
Meteorologist / weather man	35	20%		57	15%
Cartographer	11	6%		20	5%
Land surveying	18	10%		10	3%
Planning	8	5%		13	4%
Volcanologist	10	6%		3	1%
Geologist	5	3%		8	2%

What Jobs do Geologists do?

Year 7:

- 63% of students didn't know or offered no response.
- 27% stated that geologists studied or looked at things;
- 5% mentioned geohazards (earthquakes and volcanoes) as objects of study; and
- 3% provided named jobs or vocations.

Four vocations were named:

Geology Vocation	No. of Responses
Teacher	2
Scientist	2
Astronaut	1
Satellite Builder	1

Year 10:

- 56% of students didn't know or offered no response.
- 24% stated that geologists studied or looked at things;
- 3% mentioned geohazards; and
- 14% provided named jobs or vocations.

11 vocations were named:

Geology Vocation	No. of Responses
NASA	5
Oil Industry	4
Architecture	3
Archaeologist	3
Teacher	2
Geologist	1
Astronaut	1
Oceanography	1
Surveyor	1
Palaeontology	1
Volcanologist	1

Year 12 (pilots only):

- 30% of students didn't know or offered no response.
- 42% stated that geologists studied or looked at things;
- 5% mentioned geohazards; and
- 25% provided named jobs or vocations.

10 vocations were named:

Geology Vocation	No. of Responses
Teacher	15
Architecture	4
Volcanology	4
Engineer	3
Mining	3
Archaeologist	2
Scientist	2
Work in museum	1
Geologist	1
Surveyor	1
Marine Biology	1

Year 12: Geography / Geology and non-Geo Students: 34 Geography (22%) and 71 (19%) non-Geo students didn't know or offered no response (100% of the 19 Geology students responded).

	Study / Research	Geohazards	Vocational
Geography Students	45%	7%	34%
Geology Students	11%	5%	100%
Non-Geo Students	44%	2%	36%

A total of 30 different named vocations were offered (Geology students identified 13, Geography students, 15 and non-Geo students, 25). Those that were named by 3% or more students are listed below (some student's responses may fall under more than one category):

	Geology Students			Geography Students			Non-Geo Students	
Geology Vocation	**No. of Responses**	**% of all Responses**		**No. of Responses**	**% of all Responses**		**No. of Responses**	**% of all Responses**
Teacher	16	84%		4	3%		30	8%
Volcanology	10	53%		7	4%		3	1%
Seismologist	9	47%		2	1%		2	1%
Oil Industry	6	32%		9	6%		15	4%
Mineral Exploration	6	32%		4	3%		10	3%
Palaeontology	4	21%		10	6%		20	5%
Archaeology	3	16%		12	8%		39	11%
Mining	3	16%		3	2%		17	5%
Geophysics	2	11%		1	1%		1	0%
Surveying	1	5%		5	3%		6	2%
Geologist	0	0%		8	5%		22	6%

What Jobs do Environmental Scientists do?

Year 7:

- 68 (41%) students didn't know or offered no response.
- 32% stated that environmental scientists study or look at things;
- 12% mentioned the environment; and
- 10% suggested 'caring for the environment'.

Only two students mentioned named jobs. One student suggested "car macanic [sic], scientist, teacher" and one suggested 'Teach Environmental Science".

Year 10:

- 63 (54%) students didn't know or offered no response.
- 21% stated that environmental scientists study or look at things;
- 6% mentioned the environment;
- 1% suggested 'caring for the environment'; and
- 13% suggested named jobs or vocations.

12 named jobs were suggested in total:

Environmental Science Vocation	No. of Responses
Teacher	5
Zoologist	2
Conservationist	2
Botanist	2
Scientist	1
Doctor	1
Pollution adviser	1
Environmentalist	1
Tree doctor	1
Vet	1
Rockologist	1
Meteorologist	1

Year 12 (pilots only):

- 53 (48%) of students didn't know or offered no response.
- 25% stated that environmental scientists study or look at things;
- 2% mentioned the environment;
- 6% suggested 'caring for the environment'; and
- 11% suggested named jobs or vocations.

9 named jobs were suggested in total:

Environmental Science Vocation	No. of Responses
Marine biology	2
Teacher	4
Town planner	1
Surveying	1
Environmental control engineer	1
Environmentalist	1
Gardener	1
Council worker	1
Animal welfare	2

Year 12: Geography / Geology and non-Geo Students: 54 (31%) Geography and 92 (25%) non-Geo students didn't know or offered no response.

	Study / Research	Care for the Environment	Environmental Management (finding solutions)	Vocational
Geo Students (129)	27%	13%	8%	28%
Non-Geo Students (279)	34%	13%	7%	28%

A total of 45 different named vocations were offered (Geo students identified 25 and non-Geo students, 36). Those that were named by 3% or more students are listed below (some student's responses may fall under more than one category):

	Geography / Geology Students			Non-Geo Students	
Environmental Science Vocation	**No. of Responses**	**% of all Responses (129)**			**% of all Responses (279)**
Teacher	9	5%		17	5%
Scientist	10	6%		15	4%
Environmentalist	12	7%		12	3%
Meteorologist	4	2%		10	3%
Environmental change prediction	2	1%		11	3%
Environmental scientist	1	1%		11	3%

Discussion: Career Aspirations and GEES Career Perceptions

As illustrated in the table below, at all school years the majority of students think about their future career in terms of a named job or vocation. In many cases these are jobs which are 'seen' on a regular basis i.e. they come within the students' sphere of influence (either directly or through the media) e.g. doctors, vets, teachers, journalists:

	Year 7	**Year 10**	**Year 12 (pilots)**	**Year 12 (Geo)**	**Year 12 (Non-Geo)**
% career aspiration = vocation	64%	63%	67%	60%	62%
% suggest vocation for Geography	18%	44%	41%	64%	47%
% suggest vocation for Geology	3%	14%	25%	100% (Geol students) 34% (Geog students)	36%
% suggest vocation for Env Science	1%	13%	11%	28%	28%
No. who want to be one of suggested GEES vocations	14 Teachers 3 Architects 1 Scientist 1 Planner 1 Journalist	6 Teachers 3 Doctors 3 Vets 2 Pilots 1 Architect 1 Archaeologist 1 Oceanographer 1 Geologist	6 Teachers 5 Engineers 3 Surveyors 2 Business Managers 2 Journalists 2 Architects 1 Marine Biologist	13 Teachers 6 Engineers 3 Architects 2 Geologists 1 Archaeologist 1 Bin man 1 Conservationist 1 Environmentalist 1 Estate Agent 1 Scientist 1 Volcanologist 1 Oceanographer 1 Chemist	18 Engineers 15 Teachers 15 Journalists 6 Accountants 3 Architects 4 Economists 3 Photographers 2 Biologists 2 Pilots 2 Scientists 1 Surveyor 1 Environ Manager 1 Anthropologist 1 Forensic Scientist 1 Historian

When asked what jobs they thought geographers, geologists and environmental scientists might do, interestingly, at all school years many students could not come up with a named job but wrote something vague such as 'study rocks', 'travel the world' and so on. Of those jobs they could name, the greater proportion were again those that are 'seen' e.g. weatherperson / meteorologist, teacher (although lots of jobs were suggested mostly these were only by one or two students). Of all the students, those studying Geology A level had the best idea of the variety of jobs in their subject area (all 19 students were able to name geology-related vocations).

It could be inferred, therefore, that because school students tend to think in terms of named jobs and because many such jobs in GEES are 'hidden' (i.e. you don't tend to meet them on a regular basis), it is difficult for students to see the relevance of studying these disciplines in their lives.

Where the students' own career aspirations matched their year group's suggested GEES jobs (see table above) these tended to be in areas not necessarily related to GEES HE courses (e.g. architecture, journalism, archaeology, engineering etc).

Of the 946 students surveyed only 9 mentioned wanting to pursue a career directly related to the GEES disciplines (2 oceanographer, 3 geologists, 1 conservationist, 1 environmentalist, 1 volcanologist and 1 environmental manager). It can be argued, of course, that GEES graduates can move into a wide variety of jobs. However, many of the GEES-related vocations suggested by the students actually require study in a different degree subject (e.g. archaeology, architecture, engineering).

Many students suggested 'study…' or 'look at…' as possible jobs for geographers, geologists and environmental scientists. However, as the table below shows, only 4 out of the 946 students surveyed mentions the word 'research' as a career aspiration (and none used the words 'study' or 'look at').

	Year 7	Year 10	Year 12 (pilots)	Year 12 (Geo)	Year 12 (Non-Geo)
% suggest 'study' for Geography	42%	15%	25%	37%	35%
% suggest 'study' for Geology	27%	24%	42%	11% (Geol students) 45% (Geog students)	44%
% suggest 'study' for Env Science	32%	21%	25%	27%	34%
No. who want to 'study' or research	0	0	0	0	4

It could be inferred from the data, therefore, that there is a mismatch between students' perceptions of career opportunities in the GEES disciplines and their own idea of getting a job, particularly at years 7 and 10. The literature review noted that there is a cumulative process of evolving perception and achievement that influences degree subject choice and, for most people, this starts well before the age of 14 years. The challenge for the GEES community, therefore, is to find a way to market itself in order to make it highly relevant to children of all ages.

These findings, regarding the perceived relevance of career opportunities in the GEES disciplines reflect those reported in the literature review (in particular in Lord & Johnson's 2005 review of the National Curriculum: see http://www.qca.org.uk/downloads/pdf_05_1694_pupil_update_report_march05.pdf) and anecdotal evidence from colleagues in the GEES communities, for example:

> *"for quite a long time now, I have been giving a presentation to schools, colleges, careers advisors etc focusing on the societal and personal value of the subject knowledge, skills and attributes that are developed (and which are very attractive to employers) via the study of Geography and Environmental Science. The response to this talk is generally very positive and usually involves surprise about the nature of the subjects and the range of careers graduates enter."* Mike McGibbon, University of Greenwich

4: School Children's Interest in GEES-related Topics and in Planet Earth

Interest in GEES-related Topics

In the pilot questionnaire, we asked the students to rate specific topics and broad subject areas in terms of how much they enjoyed them:

1. I dislike it a lot
2. I dislike it
3. I enjoy it
4. I enjoy it a lot
5. I don't know

The following graphs illustrate the findings for the percentage of students who 'enjoy' or 'enjoy a lot' the listed topics / subjects.

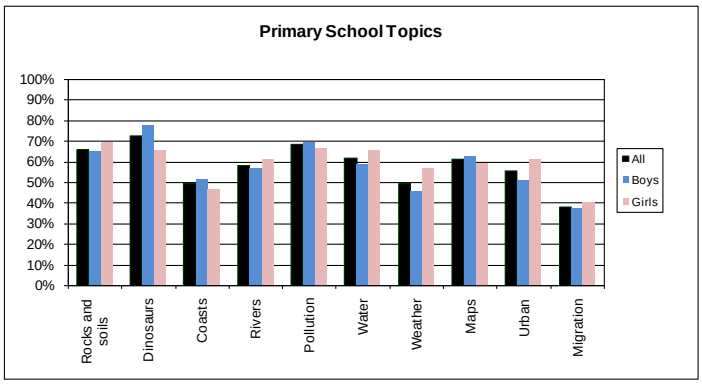


Fig 4.1: % of year 7 students who responded 'enjoy' or 'enjoy a lot' to the list of GEES-related topics studied at primary school.

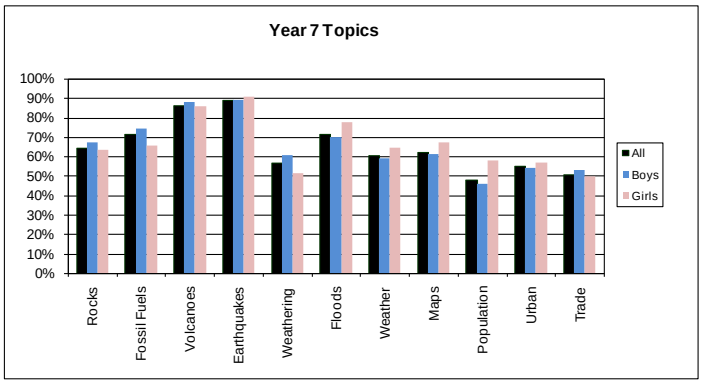


Fig 4.2: % of year 7 students who responded 'enjoy' or 'enjoy a lot' to the list of GEES-related topics studied at year 7.

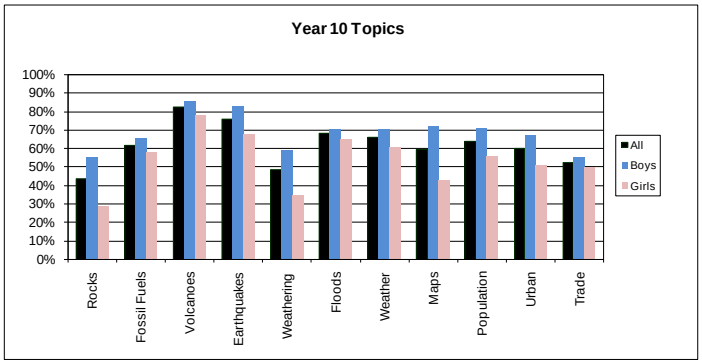


Fig 4.3: % of year 10 students who responded 'enjoy' or 'enjoy a lot' to the list of GEES-related topics studied at year 10.

Interest in most GEES-related topics is fairly high; at primary school ‘dinosaurs’ is the most popular topic and at secondary school ‘volcanoes’ and ‘earthquakes’ are the most popular in both years surveyed. For year 7 there is no statistically significant difference in responses between boys and girls. At year 10 ‘rocks’, ‘weathering’ and ‘maps’ are significantly more enjoyed by boys than girls.

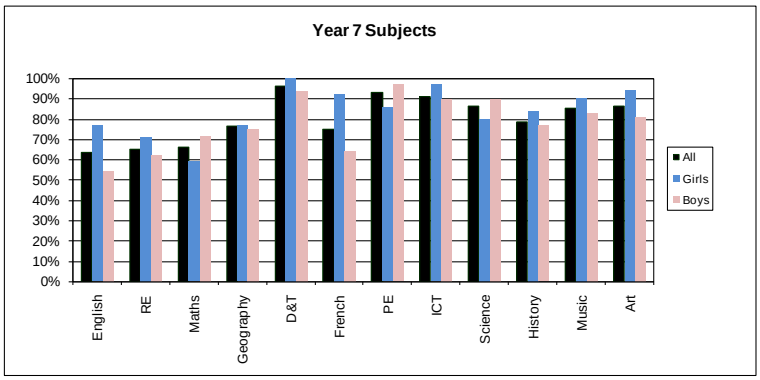


Fig 4.4: % of year 7 students who responded ‘enjoy’ or ‘enjoy a lot’ to the main subjects studied at year 7.

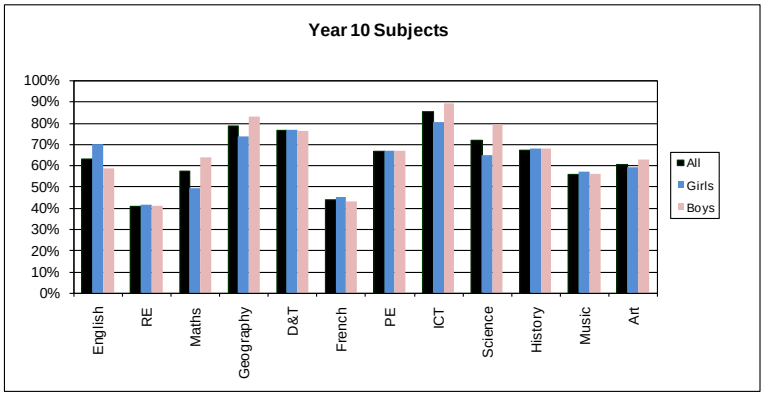


Fig 4.5: % of year 10 students who responded ‘enjoy’ or ‘enjoy a lot’ to the main subjects studied at year 10.

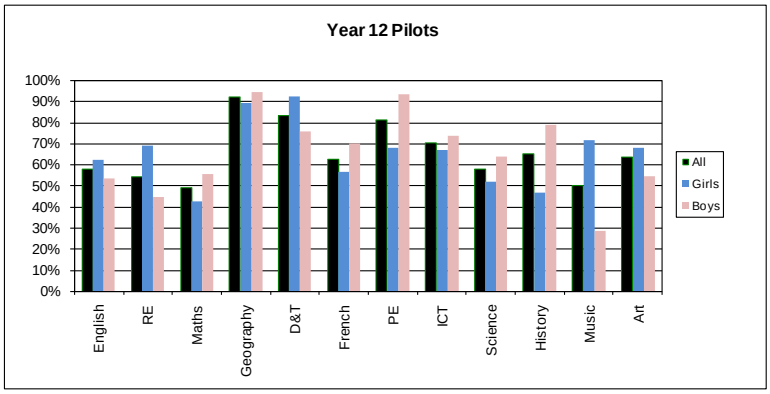


Fig 4.5: % of year 12 students who responded ‘enjoy’ or ‘enjoy a lot’ to the subjects studied at year 12 (A levels).

For all years surveyed, geography features highly in terms of enjoyment. At year 12, ~90% of students enjoy geography or enjoy it a lot.

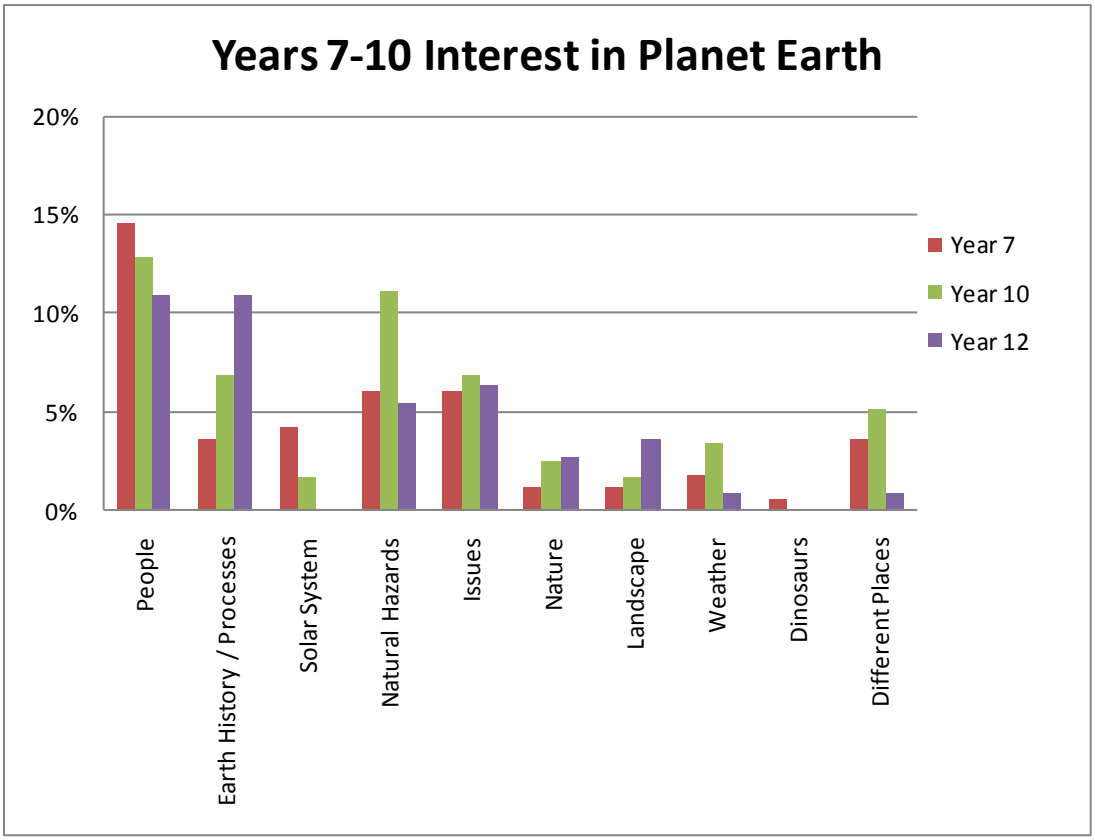
In their 2005 review for the QCA of pupil’s perceptions and experiences of the National Curriculum, Lord & Johnson, highlighted the following findings with respect to geography learning and teaching:

- In general concern is expressed that there seems to be an under-recognition by school students of the usefulness and relevance of geography;
- School students tend to prefer ‘hands on’ activities when learning a subject, however, their perceptions of teaching in geography were related to the use of videos and text books; and
- Many students found geography to be much harder at GCSE than at lower years and often cited it as the hardest of their GCSE subjects.

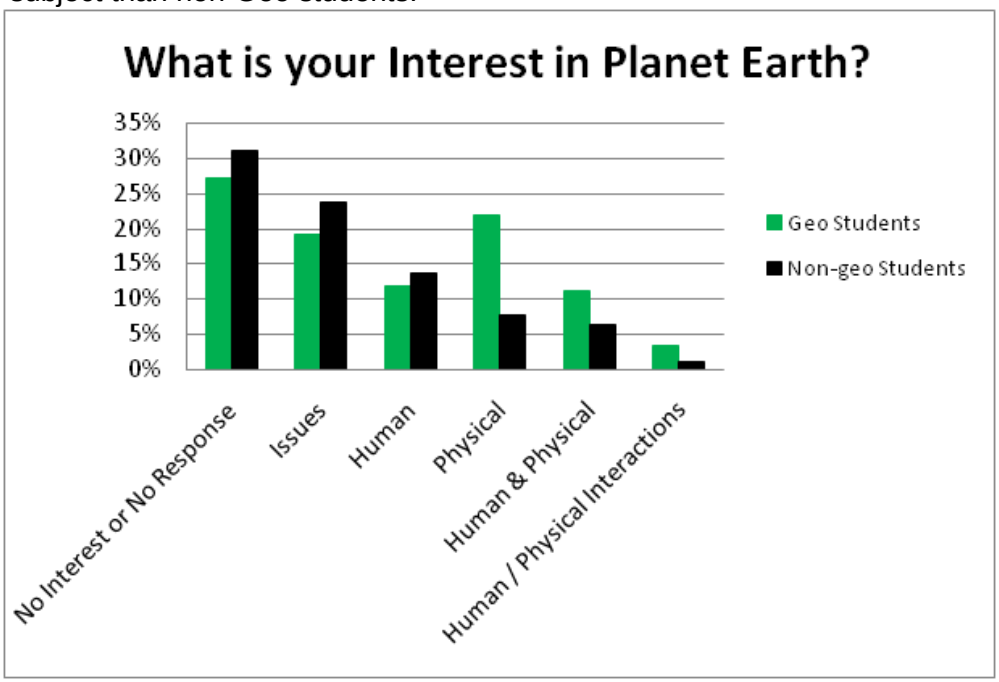
What are your Interests in Planet Earth and its People?

In the pilot studies, ~ 55% of each year group either expressed no interest or offered no response. Of those who provided a response, many different aspects were suggested but a general categorisation indicated two particular areas of interest across all three age groups:

- people and cultures (approximately 15% of respondents) and
- issues (natural hazards, global warming etc: approximately 20% of respondents in total).



Interestingly, A level students studying geography / geology tended to be more interested in the physical aspects of the subject than non-Geo students:



5: Conclusion and Recommendations

The study was intended to act mainly as a pilot in order to identify key areas for further, more in-depth research. The resourcing of the project was such that, although common questionnaire and teacher-guidelines were sent to all participating schools, it was not possible for a team member to attend each questionnaire-completion session. It cannot be guaranteed, therefore, that the conditions were the same in each school. In addition, the students were asked to write their response – variations in writing ability and effort put into the task will also affect the responses; for example, it is likely that the responses are 'off the top of the student's head' rather than having been well considered. Furthermore, the data analysis was to some extent subjective and another author might select different categories. Even with these caveats, however, it is still possible to draw out some strong conclusions and recommendations for future work.

Conclusions
In general, the students had a reasonable perception of geography though the element of *interactions* between humans and the physical environment only featured in a very small number of responses.

There was a general impression that the students were not familiar with environmental sciences as a discipline but, perhaps evoked by the word 'environment' were able to offer interesting guesses as to its nature; indeed the Year 7 students provided the most imaginative responses (compared to the 'science of the environment'-type answers from year 12), this may be as a result of the emphasis on environment, recycling etc in primary schools.

It was clear that, of those students who offered an answer, many students knew that geology was about rocks. Very few students were able to provide more detailed answers and only one or two mentioned the concept of time. Interestingly, 30 Geography / Geology students suggested something to do with oil as a possible vocation for geologists even though none of them mentioned fossil fuels as part of what geology is all about. This suggests that the students do have a deeper understanding of the discipline than just 'rocks' but that their immediate reaction to the word 'geology' is this particular stereotype.

In order to enhance interest in the disciplines and, hence, recruitment into HE we need to work on changing the stereotype perceptions. **This research and that of others suggests that school students have a lack of understanding of the relevance of the GEES disciplines to their daily lives.**

There are many career avenues through which a degree in GEES may take a graduate (and some apparently tangential to the content of the courses) and this is a great strength of the disciplines. However, around ⅔ of school children tend to think about their own careers in terms of named jobs or vocations. A small number are more general (e.g. I want to do something with computers) though in our survey none of the year 7 or 10 students mentioned a GEES subject and only 4 of the 664 year 12 students wanted to do 'something related to' GEES. **This research and that of others suggests that school students are unaware of the usefulness of the GEES disciplines for their future careers.**

Recommendations
This project has indicated that a lot more work needs to be done to enhance school children's understanding of the relevance and usefulness of the GEES disciplines. Subject choice is an evolving process that begins well before A level and even GCSE. **Outreach activities must start early in the school curriculum and be sustained through to HE.**

There are many examples of pockets of outreach activity in GEES but these mostly occur in the each of the disciplines separately. I believe that it is time that **the overall GEES community needs to come together to develop a more strategic approach**. By increasing the overall number of children interested in studying planet Earth and its people each discipline will be drawing from a larger pool.

Perhaps fully fledged 'GEES' academics find it difficult to remember a time when they didn't know about the disciplines. So **school children themselves should be involved** in developing outreach activities in

order to ensure that they are being communicated to in their own language and **assumptions are not being made** about what they already know or don't know.

So what activities might the GEES community pursue?

- **Further research** is certainly required in order to gain a deeper understanding of the perceptions of the disciplines.
- To follow up this project, it would be really interesting to **get the school students to study and illustrate the usefulness and relevance of the GEES disciplines**, for example through running a poster competition.
- Run a GEES **roadshow** – take a bus around the UK giving demonstrations and so on.
- Other ideas?

Dr Helen King
Assistant Director, GEES Subject Centre
July 2007

Appendix A: Project Team Members

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Ian Mack	University of Central England
Mike McGibbon	University of Greenwich
Phil Murphy	University of Leeds
Rhu Nash	Southampton Solent University
Kehinde Oduyemi	Abertay Dundee
Andrew Parker	University of Reading
Chris Ribchester	University of Chester
Victoria Robinson	University of Leeds
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Suzie Stacey	University of Chester
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Appendix B: Literature Review and Recommendations

Roger Trend
Oct 3rd 2006

Contents

Introduction

Human perception and choices are such complex issues that the structure of any formal literature review is bound to be contrived. To some extent, therefore, the structure of this review, imposed on the huge array of empirical research and philosophical comment, is somewhat arbitrary. On another day the subheadings would be different. Furthermore, to avoid repetition, the content under each section also has a degree of arbitrariness.

First, there is a large research literature on students' perceptions and choices through compulsory schooling but far less dealing with perceptions at 17/18+ years. This school research has implications for the current research project since it is clear that students' subject choices at 17/18+ evolve over many years and are strongly influenced by those school-related issues: they do not come out of the blue half way through A Level studies.

A second large body of literature relates to continuation with education at 16+ years. Much of this research is driven by national policy imperatives and addresses academic/vocational contrasts. Again, although this research is peripheral to the current project, some of it addresses course choice and this has clear implications for my recommendations.

In addition to these large research fields, others are reflected in the sections below. Issues at FE/HE transition are becoming important research topics, including student perceptions in both directions, and the latest research follows from significant research on transitions in children's lives, including school transfer at 11+ years.

The GEES disciplines

This brief section deals with the school-based and HE-based implications arising from the fact that GEES is so broad, covering science and non-science knowledge.

One key issue concerns the relevance of much of the literature for the GEES disciplines. The subject focus of GEES activity is diverse, especially within geography where the human/physical dichotomy is perceived to be alive and well in many quarters (Johnston, 2006). GEES includes both science and non-science subjects and methodologies; that is relevant to the current project because much research into perception, interest, subject choice and attitude focuses on broad fields such as science, humanities and arts. This literature contains much that is generic, certainly in terms of its methodology, or at least covers a thick slice of the HE curriculum which goes well beyond GEES. However, there have been some studies that address individual HE disciplines, including geography.

Another issue relating to the GEES disciplines concerns their relationship with the school curriculum. Thanks to the National Curriculum, school curricula are visible and accessible on one level, although the complexities and realities of the taught curriculum (as opposed to the intended curriculum) are important: we cannot assume that the NC is taught in all schools with the same messages. What is written is not the same as what is taught, and what is taught is not the same as what is learnt. Furthermore, children's learning and perceptions develop under influences far wider than any school curriculum.

Evolving perceptions, conceptions, attitudes, interest and subject choice through primary and secondary school

The emphasis in this three-part section is on evolving perceptions as students progress through school, including the potential influences on them through those years.

There is a huge research literature on students' attitudes and educational choices at 16+ and 17+ years, but much of this is focused on either (i) the staying-on decision or (ii) widening participation in HE. Both clusters tend to emphasise the less-advantaged sections of society and rarely do authors address the factors which influence students' HE decisions specifically in relation to GEES disciplines. However, in many cases the decision-making is influenced by wider and more general factors (such as parents and

peers) which also impact on GEES-related HE choices at 17+ years: hence the inclusion of such research in this report.

Attitude research is very problematic, even more so when its limitations are not acknowledged or even recognised. For example, research based on students' ranking of subjects by preference has one obvious drawback: ranking a subject as bottom/last/least does not indicate a strong dislike or negative attitude towards it, merely that all other subjects are ranked higher. Thus, "it is possible for a student with an extremely positive attitude to all school subjects to still rank science as the least popular" (Osborne, Simon, & Collins, 2003, p.1056).

The GEES disciplines correspond most closely with geography and science in the secondary school curriculum, so this section is structured in three parts: generic, science and geography

a. Generic issues

Research into children's interests rarely gets beneath the surface and is in its infancy, certainly in relation to UK schooling (Trend, 2005). By contrast, research into attitudes towards school subjects, notably science, mathematics, PE and English, is well-established. Geography is less-well researched than science (Biddulph & Adey, 2003; Lord & Johnson, 2005). Stables and Wikeley (1997) cover the main issues and this large body of research literature has relevance for the present study insofar as it illuminates the choices made towards the end of secondary school. Indeed, the evolution of subject perceptions through secondary school and the subtle, pervasive influence of family, schools and teachers are two of the recurring themes of my report.

Empirical research into children's interests (Trend, 2005) shows that we need to make two distinctions: first in relation to the type of interest (situational or individual) and second in relation to the focus of interest (entire subject or just a topic within it). Almost all of the research into children's perceptions of school subjects treat those subjects as single entities: the entire subject is deemed to generate interest (or not, as the case may be). This may yield legitimate and useful results for cohesive and content-free subjects such as mathematics or French, but with content-rich subjects such as geography or science it is a flawed approach which usually misses the target. So, for example, biology, chemistry and physics are rarely treated separately and even less frequently is Earth science singled out for study. In geography there is rarely any distinction between physical, human and environmental elements.

Much research points to the importance of students' evolving interests and perceptions of curriculum subjects for their career/HE decisions at 17+ years (eg. Cleaves, 2005; Crawley & Black, 1992; Foskett & Hesketh, 1997; Hemsley-Brown, 1999). During this evolutionary process most children transfer from primary to secondary school at 11+ years, yet very little research has been done to assess the impact of this transition on perceptions of curriculum subjects. Attention to issues at the primary/secondary interface arising from school transfer at 11+ years have almost completely ignored geography (Williams & Howley, 1989). In their major report, Catling *et al* write: "there is little evidence of planned continuity and progression between Key Stages 2 and 3 on the part of primary and secondary schools" (2003, p12). Furthermore, "key stage 3 [geography] teachers do not appear to be aware of what is happening in the primary classroom, and this has clear implications for key stage 3 where standards appear to be falling" (Chapman, 2003, p.56). Chapman also writes that "failure to expand upon the geography work done at key stage 2 is leading to lower standards at key stage 3" (p. 65). Science fares rather better than geography over school transfer arrangements, with numerous published examples of science bridging units and joint meetings of primary and secondary teachers to plan collaboratively across the KS2/3 boundary (Braund & Driver, 2005; Ryan, 2002; Stephenson & Warwick, 2001)

There is no doubt at all that these evolving perceptions play a major role in GEES-related HE decisions at 17+ years, although these choice trajectories vary between individuals and some are more open to change than others. Some students (claim to) start the process before secondary school whereas others remain undecided until they are seventeen years old. Certainly the "expectation-framing" influences of family and schools start well before the age of 11 years, whether or not the pupils are conscious of them. "Choice was a dynamic process in that the precise nature of the preferences expressed by young people changed over time as a range of factors influenced their ideas" (Foskett, Dyke, & Maringe, 2004, p. 1).

There is a scarcity of genuinely longitudinal studies: Payne (2002) reported only one (Ryrie, 1981) who followed over 1000 pupils through their last 3 years of compulsory schooling in Scotland. He found a close correlation between decisions at 16+ years and intentions three years previously, but that was in the 1970s:

> "During the long period of schooling teachers influence their students in various ways, intentional and unintentional. As a result, young people come to internalise certain expectations, and adopt certain taken-for-granted assumptions. Such mutually accepted assumptions may result in decisions being made about courses or paths to be followed without any conscious choice on the part of individuals…Such decisions apparently happen "naturally", but they are the outcomes of a process which has been going on quietly in the minds of students during the earlier years, and which may have involved taking a series of small steps in a certain direction.' (Ryrie, 1981, p.3)

Cleaves' 3-year longitudinal study of a sample of 72 high-achieving students (Cleaves, 2005) shows how the decision-making process is a complex affair. She developed 5 types of choice trajectory: 'directed'; 'partially resolved'; 'funnelling identifier'; 'multiple projection' and; 'precipitating'. Each student has had a distinctive trajectory through secondary school. At one extreme, the 'directed' students had decided on their careers by the start of Key Stage 3 (aged about 11 years) and those decisions had been reinforced and strengthened through their subsequent decisions and actions. At the other extreme, 'multiple projection' trajectories are characterised by "constantly changing ideas" (p.473) and 'precipitating' ones by a total lack of any vocational commitment. Of the 21 students, ignoring other subjects, one was studying geography, one geology and one both. The relationship between choice trajectory and subject choice is relevant for the GEES research. In the Cleaves study, science was associated most strongly with the 'precipitating' trajectory. Those who had 'directed' trajectories had very clear and narrow-focused career ambitions (eg medicine) and those with 'funnelling identifier' trajectories, with a gradual narrowing of career focus, usually filtered science out of their options for post-16 study.

Finally, there are significant gender differences in perception and choice of subjects throughout schooling, but there are addressed in the section below on gender.

b. Science

Some of the GEES disciplines, notably geology and environmental science, sit astride science and geography in the secondary school curriculum but the posture is not symmetrical (Trend, 1993, 1995, 2003). The research literature on children's interest in science is enormous, far bigger than that for geography. Very little deals with GEES disciplines in any great measure, although some authors include geoscience-related topics within larger lists of science topics and one or two address children's interests in geoscience in some depth.

One large cluster of this research treats science as a single curriculum subject (or at most categorises it as biology, chemistry and physics) and addresses pupils' attitudes or perceptions, often using subject choice as an indicator of preference and often covering gender differences (Gauld & Hukins, 1980; Hadden & Johnstone, 1983; Jarman & McLease, 1995; Kelly, 1988; C. Murphy & Beggs, 2003; Parkinson, Hendley, Tanner, & Stables, 1998; Sears, 1997; Spear, 1987; Weinburgh, 1995). Gardner (1975) reviewed this work to 1975, as did Ormerod and Duckworth (1975) in the same year. Gardner wrote a further review a decade later (1985) and Weinburgh (1995) wrote a brief review in relation to gender, but several authors have noted the decline in such studies in more recent years (Pell & Jarvis, 2001; Ramsden, 1998). Through the 1980s and 1990s a clear consensus emerged concerning pupil attitudes towards science and Ramsden (1998) summarises this as:

- science is perceived as difficult and often irrelevant to pupils' lives;
- science is perceived as causing social and environmental problems;
- science is more attractive to boys than to girls;
- pupil interest in science declines through secondary school (11 to 16 years) and;

- physical sciences are perceived by children in a more negative way than are the biological sciences.

Be that as it may, there is neither consensus concerning children's GEES interests nor a sufficiently secure theoretical framework to support such work, so empirical, theoretical and philosophical research are needed to illuminate the path for GEES/science educators and researchers. Perhaps such studies might suggest ways in which the negative elements of the above summary may be addressed constructively through school teaching across both geography and science.

A second cluster of science interest studies deals with situational interest, i.e. children's preferences for particular ways of working: their learning activities (e.g. Pell & Jarvis, 2001). Practical work has been a major focus of such studies over the decades, often in the context of cognitive gains, but this has declined in recent years.

The third cluster deals with children's interests in selected science topics, and this is where geoscience items occur, typically included in lists of several dozen science topics. In the early 1980s the UK government instigated a large survey of children's attitudes and attainment in science, to be undertaken by the Assessment of Performance Unit: hence the "APU Surveys". This spawned many publications, the official government ones most relevant here being Harlen (1988) and Murphy and Qualter (1989). Harlen (1988) reported results from questionnaire sections in which 11-year-old children were asked about the extent of their experience of selected topics and whether they would like to know more about them. Of the 26 topics offered, 3 are explicitly geoscience (rocks; the weather; and water in the air). A further 3 have close geoscience links: air is everywhere; the sky; and time (although we have no data on children's conception of "time" in this context: see Trend, 1998, 2001; Trend, 2002). In terms of children's desires to "find out more", the most popular topic was "the sky", with "water in the air", "rocks" and "the weather" ranked at 11, 12 and 13 respectively. Factor analysis of the "interests" data failed to generate evidence of girls' preferences for biological features and boys for mechanical things. However, factor analysis of the "prior experience" data revealed a factor labelled "the nature study approach" (p. 16), which includes the rocks and sky topics and has parallels with the Earth Systems Science approach (Mayer, 1995; Trend, 2002).

Murphy and Qualter (1989) reported APU results for 13-year-old children, referring to the "topics of interest" questionnaire. There are significant interest differences between boys and girls, but little concerning geoscience, and the authors conclude that, in order to enhance girls' science interest, "attempts must be made to link the applications of science to the broader context of the world and its living inhabitants" (p. 18), a conclusion supported by Trend (2005), although the authors failed to make that link between the gender problem and the potential role for GEES-type education.

Qualter (1993) used cluster analysis on some of the APU data for 13-year-old children to examine gender differences in science topic interest. She extracted three groupings of topics, labelled respectively "problems of the physical world", " people, animals and their world" and "classroom science". In accordance with previous and subsequent findings, the topics of the middle cluster were "consistently more popular with girls than with boys" (p. 314). Furthermore, girls showed a greater interest in "topics with relevance to social, human or animal needs" (p. 315). Little geoscience is included in the study ("e.g. why the sea is salty"), but one pertinent comment by Qualter is that "the three major groupings which emerged from the cluster analysis cannot be described in terms of subject boundaries" (p.314), i.e. biology, chemistry and physics. Clearly, asking children to express their liking for science in terms of those three sub-disciplines is likely to conceal more than it reveals, as Qualter discovered. This has great significance for the current GEES research project. A secondary school curriculum which reflected more accurately the GEES clustering is likely to yield more reliable and powerful data on children's science interests, although Qualter did not identify this as a possible solution.

Johnson (1987) interpreted the APU interest data across the 11-15 age range, noting that "by the age of 11 years, boys already show a greater enthusiasm than girls for finding out 'how things work'. Whereas girls are interested rather in the 'aesthetic aspects of weather, colour and music' "(p. 468), as confirmed by Trend (2005).

In contrast to the huge APU surveys reported above, Taber (1991) reported on research in a single school, focussing on gender differences in science interest. He generated a list of 32 science topics by extraction from previous literature to cover 5 areas: nature study; human biology; aesthetic phenomena; machines and; spectacular and space science. The pilot study resulted in 12 topics being discarded, being those which were found to be universally unpopular. Of the remaining 20 topics, 4 are within geoscience: volcanoes, weather, rainbows and (possibly) crystals. After reporting that boys have a greater interest in spectacular and noisy topics (e.g. volcanoes) than do girls, and that girls have a higher interest in human-related and aesthetic topics (e.g. rainbows), Taber concludes that "the spectrum of gender-related interests does not seem to run from physical science to nature study, so much as from machinery to health science" (p. 250). Similar results are reported by Trend (2005) in relation to extreme events such as volcanic eruptions, and aesthetic phenomena such as clouds and landscapes.

Murphy and Beggs (2003) undertook survey research with "over 1000 children" aged 8 to 11 years in order to probe their changing attitudes towards science and selected science topics as they progressed through primary school (5 to 11 years). The 16 science topics, selected by the researchers on the grounds that they were "commonly encountered in the primary school" (p. 110), included " water cycle" and "environment", but the authors do not provide comprehensive results for each topic. The questionnaire required children to indicate "like" or "don't like" against each of the 16 science topics, an approach which is in contrast to that used by Trend (2005), which was based on "would like to learn more", with a 5-point response scale. Of the 16 topics, 12 were liked less by the older children: the water cycle, for example, appears to be liked by 80% of 8/9-year-old girls but only by 55% of 10/11-year-old girls, with almost identical results for boys. The authors conclude that "age is a more significant determinant than gender of primary children's attitudes to science, and that these attitudes become less positive as the children reach the more senior primary classes" (p. 115). This declining interest in science through Key Stage 2 has obvious implications for the current research project.

"Geoscience topic interest" must be taken as a multidimensional construct for two reasons. First, "interest" itself has several facets, notably situational and individual (Krapp, 1999). Second, geoscience is not a single phenomenon: it is a complex amalgam of concepts which can generate a multitude of learning contexts and styles. Paul Gardner argues frequently and powerfully against the naïve and over-simplistic study of children's interests in science (P. L. Gardner, 1975, 1985, 1995), pointing out that interest in science is essentially multidimensional since different children will be interested in different topics and various ways of working. In particular he argues against the development of attitude scales which are constructed in the absence of any underlying construct, "the worst case scenario [involves] researchers who fail to define the variable they are trying to measure and throw together a diverse set of items which have no common underlying construct at all" (P. L. Gardner, 1995 p. 284). In an earlier paper Tamir and Gardner (1989) examined the structure of interest in high school biology among 900 15-year-old Israeli students, identifying eight interest dimensions at the start. Among many other findings, they concluded that

> "interest in a specific biological topic is often associated with its social implications [and that] tenth grade girls exhibit, on average, a higher level of interest in the content and process of biology. This higher interest does not affect achievement. At the same time, boys are more interested in the applications of biology" (p. 134).

Haussler *et al* (1998) also address Gardner's concerns, identifying three dimensions to the "interest in science" construct and applying the theoretical framework discussed above to issues of pupil interest in physics. Also in relation to physics, Hoffman (2002) reports on one aspect of a large and wide-ranging study into children's interests, cognitive gains and self-concepts, a project which used the "wanting to learn more about" instrument for obtaining interest data.

As a warning against interpreting ambiguous research findings, Daniels and Welford (1992) reported that the APU research cited above linked dynamic tasks (i.e. situational interest) disproportionately with physics (i.e. topic interest) and static tasks disproportionately with biology. Consequently, when children expressed a preference for one cluster of tasks over the other, the researchers couldn't tell if they were expressing an interest in the tasks (e.g. dynamic) or the subject (e.g. physics). As the authors tactfully state, "early analyses were confusing and heterogeneous" (p. 8).

Finally, many of the constraints noted above can be overcome through an approach to analysing students' perceptions and interests less in terms of broad (school or HE) subject labels, but more in terms of selected topics and ways-of-working across the full breadth of GEES disciplines, including all facets of geography as well as Earth and environmental sciences

c. Geography

Compared with science, the literature on children's perceptions of geography, including their expressed interest, is small. Catling (2001) looked at children's perceptions at the end of Key Stage 2 (age 11 years), noting that 15% of them could provide no definition of geography at all. Most children express their perceptions in terms of mapwork, the world and countries. In general they "have a narrower image of the subject than some geographers might contend is accurate ..[but this is the] ..one that the majority of children take with them from primary to secondary school" (p.374). This corresponds to similar findings in Hong Kong among older children (Lam & Lai, 2003). Catling suggests that these KS2 perceptions of geography reflect the general public perception of the subject. There is increasing concern about the diminishing role of geography in KS2 and it was singled out by the UK government in 2005 for special attention and additional funding.

Children's perceptions at the end of Key Stage 3 are examined by several authors, usually in relation to GCSE option patterns. Weeden (2007) and Biddulph and Adey (2004) note the influence of enjoyment and relevance on GCSE choices. Although two-thirds of KS3 students perceived geography as being generally 'useful', many found it difficult to identify any real purpose for studying it. Some could see it as being useful for travelling and map-reading and others useful for a career in the tourism industry: clearly stereotypical views of geography still prevail in some schools! Adey and Biddulph (2001) found that children distinguished between interest and enjoyment in geography, the former relating to subject content and the latter to the learning processes (these correspond to individual and situational interest respectively, although the authors do not refer to that body of literature). They conclude that enjoyment alone is insufficient reason for studying geography at GCSE and beyond and that there is widespread ignorance among Year 9 students of the relevance of geography for careers.

When it comes to pupils' GCSE choices of geography, it seems that both enjoyment and relevance have to figure large in their perceptions if they are to choose that subject; enjoyment alone is insufficient to trigger selection. Hopwood (2004) and Hopwood *et al* (2005) studied perceptions of geography expressed by Y9 pupils who saw geography in terms of (i) the world and how it works, (ii) countries or places in the world, (iii) people and ways of life, (iv) world problems, especially disasters. Map reading was also seen as the most distinctive geographical skill.

Nearly a decade ago Stott *et al* (1997) found that higher-ability students in Year 9, in choosing their GCSE subjects, were more likely to be influenced by interest in the subject and their prior attainment, compared with less-able students who were more likely to be influenced by parents and teachers.

In his literature review on perceptions of school geography, Weeden (2007) identifies three groups of influences on choice at 14+: (i) enjoyment of geography, or interest in it, in terms of content and the pedagogy, (ii) perceptions of geography's usefulness and importance, (iii) their own ability and success in geography. Drawing on Trend's (2005), empirical research into children's conceptualisations of geoscience, Weeden expresses many of the geography-related issues in term of situational and individual interest: ie pedagogy and enjoyment respectively. Elsewhere Weeden (2005) also notes the evolving perception of career options in relation to geography, suggesting that "most 14 and 16 year olds: make unrealistic connections between subject choice and careers; are unclear about future careers; have very fluid ideas about careers" (p.6)

In 2004 Norman and Harrison (2004) focused on the perceptions of geography held by 400 Year 9 students who were about to embark on GCSE studies. They presented some findings in terms of student "likes" and "dislikes": the most popular activities being: finding out about other countries; watching videos; and field trips and the least popular activities being; writing; atlas/mapwork; and copying from board. They also noted that pupils have clear ideas of the usefulness of geography, not only in terms of

map reading (1st) and travel (2nd) but also understanding world events (3rd) and understanding the weather (4th).

Influence of schools, teachers and careers/HE advisors

This section deals with the impact of teachers on the HE- and career-related decisions at 16+ and 17+ years.

There is no doubt that schools and teachers have an important influence on students' perceptions of GEES subjects and on education choices at 14+, 16+ years and beyond, but the nature and timing of this influence are very subtle, as many authors comment. Furthermore, the influences of schools and teachers take at least two forms; the visible and explicit advice and guidance given to students at specific times and; the pervasive, subtle and continuous influence through conveyed expectations, examples and norms, part of the well-documented "hidden curriculum". This second category of influence can be represented as an 'expectation framework', often surrounding the student since birth, within which students make their educational choices. Also, practices in schools can affect the ways in which gender, social class and ethnicity influence subject choice (Stables, 1996).

Right from the start it is important to note that "school was less of an important source of advice than parents or home-related influences for pupils likely to pursue academic post-16 pathways" (Foskett *et al.*, 2004, p.2). Schools influence children's perceptions throughout their school lives and much research indicates that this ongoing influence is more significant for HE choice than the more immediate and visible influences of careers and HE guidance at 16+ and 17+ years. Even the concept of "HE choice" is complex: are we talking about HE aspiration *per se,* choice of HE subject or choice of HE institution? I suggest that the influences on staying-on and A Level subject decisions at 16+ years have much in common with those influencing HE institution and subject choice.

Decision-making is complex. Young *et al* (1997) comment on the "complexity of factors which influence student choices" (p. 21) and, in the context of Australian HE marketing, James (2002) notes that "choosing a university course involves a choice and application process exceedingly more complex than most consumer decisions people make". Similarly, in their study of 10,000 potential school leavers in Derbyshire, Fergusson and Unwin (1996) note the extreme complexity of the multiple influences of social class, academic performance, parental income and staying-on rates.

The various typologies of influence on student's HE and career decisions of recent years include various facets of school and teacher characteristics. In their major study of school influences on 16+ decisions for the DfES, Foskett, Dyke & Maringe (2004) identified six school-based factors: "school type; available careers programme; socio-economic status of the school catchment; school leadership, culture and ethos; teacher influence; and subject curriculum issues" (p.1). Each of these has been examined further by other researchers. Under their "in-school factors" category of influences on Western Australian students, Young, Fraser and Woolnough (1997) list the following: "teacher enthusiasm; access to career information and advice; teacher-centred learning; and HE incentive – ease of entry to HE " (p. 209). In a similar vein, Morris & Rutt (2005) note that, in relation to school factors, "the most influential interventions appeared to be "discussions with teachers about higher education; the opportunity to visit universities or higher education institutions; lessons on transition skills such as writing curriculum vitae and preparing job or course applications" (p.iii).

Most of the research about school influences is derived from student or teacher perceptions of those influences: few studies attempt to evaluate directly the impact of schools and teachers on HE decisions. Accordingly, many of the research findings have to be viewed through that perception filter. For example, Keys *et al* (2004) and Ridley *et al* (2005) present their findings in terms of teachers' or students' perceptions, but others, such as Bratti (2006) and Garratt (1985) make that filter less explicit. Indeed, Garratt (1985) states that 30% of Y12 students thought that teachers and parents had no influence at all on their HE and career decisions, yet fails to address anything akin to an expectation framework within which the students make their decisions, nor does he draw attention to any perception filter.

It is impossible to separate issues of careers/HE education from the wider and more subtle school influences, often manifest through the so-called school climate or ethos. “Schools with a more pupil-centred ethos, rather than school-centred, often built a richer and broader understanding of post-16 routes” (Foskett *et al.*, 2004). The government programme for HE and careers guidance known as ‘Connexions’ is important for most students, notably the Personal Advisers (Foskett *et al.*, 2004), and there is a growing tendency at 16+ years to opt for “subjects combining vocational and academic learning” (Foskett *et al.*, 2004, p.6).

The school curriculum influences student perceptions of subjects from the earliest of ages and much research examines student perceptions and choices in science, geography and other subjects through the secondary school years (see separate section of this report). Clifford (2002) perceives a “divorce between [geography] in the university and the schools, where … geography is fast disappearing into environmental or humanities course programmes” (p.435).

Individual teachers make a big difference directly and indirectly, through their enthusiasm, teaching, knowledge, age, example and expertise. As noted above, this influence on pupils is manifest in two ways; (i) the explicit advice and guidance on subject choice and HE given at certain times and (ii) the more subtle messages sent over many years through their attitudes and enthusiasms. The first has been investigated far more widely than the second, yet it is likely that the “ongoing messages” influence is more significant. Many authors state that teachers need to know that they influence children’s HE and career aspirations as they evolve through the secondary school years (Crawley & Black, 1992; Payne, 2002). For many students, teachers are seen as mentors, although there are few recent reports in the literature of research into the impact of mentors or role models on students’ science enrolment choices (Dalgety & Coll, 2004, p.61). This mentor concept has subtle and important consequences for subject perception and HE choices when students identify their teachers as role models. In research into the perceptions of 37 New Zealand first year chemistry undergraduates, Dalgety and Coll (2004) found that “many” identified their former chemistry teacher as a mentor, although others chose family or friends. In this case, mentors’ perceptions (of chemistry) reinforced those of the undergraduates. One recommendation in this report is for closer links between the “chemistry community” and secondary school students. For pupils in high socio-economic status areas, “teachers and class tutors were generally viewed by young people as having little or no influence on the post-16 choices of pupils, except where teachers were perceived to be ‘inspirational’” (Foskett *et al.*, 2004, p.3)

Teachers’ enthusiasm for their subject is often, but not universally, cited as an influence on student choice: (Young *et al.*, 1997), although it is often implied when students report that their enjoyment of the subject influences their HE choices (eg. Morris & Rutt, 2005). Byrne and Flood (2005) report that over 75% of their sample cited “enjoyment of the subject in school” as an important influence on degree choice. Ashworth and Evans (2001) report on “a number of factors that make a difference in the decision to study economics [at university]: mathematical ability, prior study of economics, underachievement in economics, and certain features of the classroom environment are all of some relevance” (p.318), although they do not specify those “certain features”. Biddulph and Adey (2003) review the literature on children’s enjoyment of lessons in general and geography (and history) in particular, referring in their empirical study to the fact that children’s enjoyment of the subject is equivalent to situational interest (Hidi & Baird, 1986).

The nature of A Level teaching is often cited as an issue for transition into HE courses, causing disruption and some HE drop-out. One perception among HE teachers is that A Level teaching is probably “strongly didactic”, with teachers telling them “precisely what to learn” (Bradbeer, Healey, & Kneale, 2004, p.32). This is presented by the authors as a contrast to HE teaching which requires more independence. In the Irish context, Byrne & Flood (2005) note that “the teaching and assessment practices experienced at school may cultivate a particular set of study skills and a learning orientation that may not be entirely appropriate for the more independent forms of learning expected in higher education …[and] …students who commence university with didactic/reproductive beliefs about knowledge and teaching find the transition to higher education difficult and even traumatic” (p. 117). Cook and Leckey (1999) report that "many students arrive at the university with unrealistic views about the amount of work expected and the size of classes in which they will be taught" (p. 168). They perceive new HE students to have a narrow range of secondary school subjects which does not prepare some students adequately for HE study. Some students lack an understanding of key concepts or have

inappropriate study skills. Others write that “A-Level students tend to consider themselves ill-prepared for higher education in terms of coping with both teaching styles, such as the formal lecture, and study skills, such as private reading, note taking, time management, asking questions in large groups, team/project work and IT competence” (Lowe & Cook, 2003, p.54).

Australian geography teachers are getting old or they are being promoted out of the geography classroom (Cranby, 2001), thereby becoming out of touch with the latest HE developments in their subject and less able to advise on HE courses. Keys *et al* (2004) note the variable levels of teachers’ HE knowledge and expertise, especially those of Y12/13 teachers, recommending short courses and other INSET on “new developments in HE, the implications of different A Level combinations for entry to higher education, and other relevant issues” (p.16).

Keys *et al* (2004) report differences in the nature and quality of teachers’ HE/careers advice according to their relative levels of knowledge and understanding of HE issues. First, there are differences between schools: those with sixth forms were more likely to give good advice to 16+ students on HE implications than were 11-16 schools. Second, heads of post-16 education see themselves to be better informed of the latest HE courses than are Y12/13 subject teachers and heads of KS4. Third, about 75% of KS4/5 teachers felt they knew much about HE issues, but only 50% knew about HE summer schools. Fourth, although most schools (90%) made use of a wide range of mechanisms for HE advice, the following were used by only 75%: information evenings; talks by university students; encouragement to attend HE summer schools, and the following even less frequently: talks by people in different professions; visits to employers.

Much empirical research has been done concerning students’ changing perceptions between the ages of 11 and 16 years and their choices at 16+ years, as indicated above. There is no doubt that this is an important theme in the literature which has implications for students’ subject perceptions and their HE choices. Although these issues are addressed in a separate section of this report, the role of the school and individual teachers is crucial. In relation to staying-on decisions (and probably wider ones too), “there appear to be differences between schools in pupils’ attitudes towards education” which cannot easily be explained (Payne, 2003, p.5). This is not very helpful for the present study. However, in the context of choices made by USA pupils across Grades 8 to 11 (ages 13 to 16 years), Crawley & Black (1992) note that "beliefs about the consequences of enrolling in physics are formed early in secondary school years. Unfortunately those beliefs tend to become less favourable the further the students progress in secondary school" (p. 595). They conclude that teachers and researchers should encourage students early in secondary school to aspire to professional careers, especially in sciences and physics. "we must also provide them with information about the importance of science study for career preparation" (p. 595).

Careers education in schools has received much attention by researchers and others, the most recent set in the context of 14-19 reforms. The main thrust of the message for the current project is summarised by Payne (2003) who reports that “the evidence suggests that the formal careers education and guidance offered by professional careers teachers in schools and careers advisers outside of school, though helpful to a number of young people, is not generally as strong an influence on choice at 16 as family” (p.42). Over the years many government and local policies have been analysed and evaluated but only the most recent ones have direct relevance for the current research. For example, the findings by Taylor (1992) from 1355 Year 11 students that there were large differences between schools in their careers support, with boys being more likely to take part in formal careers activities than girls, is probably now irrelevant. The nature, quality and timing of more recent careers/HE advice is addressed by the major surveys mentions above (Foskett *et al.*, 2004; Keys *et al.*, 2004; Morris & Rutt, 2005; Payne, 2002, 2003; Ridley *et al.*, 2005). One small study of Year 9 children’s perceptions of the influences on their 14+ choices reported that teachers had a negligible influence (Dawson & O'Connor, 1991), although this may be a measure of pupil unawareness or reluctance to admit it.

Morris (2004) provides a summary of the findings from “a number of large-scale research studies” (p.1), not only commenting on the rapid expansion of Personal Advisers under the Connexions programme (nearly 8,000 in Sept 2003) but also on the difficulties being experienced by schools in providing an adequate service. In 2004 the National Audit Office had reported that “many schools do not have the

capacity to play their part in providing good quality, impartial careers advice that will enable [young people] to make learning and career choices" (Morris, 2004, p.6).

Research shows that sixth forms in 11-18 schools are rather more likely to generate HE applications than are post-16 colleges, but:

> "attitudes towards higher education were as positive amongst young people who had left 11-16 schools to attend college as amongst those who were in school sixth forms, suggesting that, amongst young people in colleges, there may be a need to focus more on raising aspirations to higher education than on simply raising awareness of such opportunities" (Morris & Rutt, 2005, p.14).

This will have implications for the present study if that finding applies equally across the ability range of 16+ students. Furthermore, the availability of Opportunity Bursaries influenced students' decisions at 16+ years once they had heard of them (Morris & Rutt, 2005).

Some authors report that schools' careers/HE guidance and advice is not as influential as that of family members (Payne, 2003). They act more as catalysts, giving pupils a sense of urgency (Macrae, Maguire, & Ball, 1996). Other research suggests that the main influence of school-based careers/HE advice is on course of study (White, Stratford, Thomas, & Ward, 1996) and one author suggests that such careers advice is more likely to lead students into vocational courses (Witherspoon, 1995).

Much of the careers-related research includes an examination of gender differences, but these issues are addressed in a separate section of this report.

Perceptions of relevance to career, income and employability

This section covers the perceived influences of career opportunities, lifetime income and general employability on students' HE decision-making at 17+ years.

It is clear that career opportunities, employability and potential income are now perceived by students and HE lecturers to be the dominant influences on HE subject choice for many, if not most, students when they make their choices at 17+ years, a situation that has emerged only over the last few years (Rolfe, 2001). However, this apparently unambiguous finding from many researchers conceals three important factors which distort the picture, all of which are addressed in separate sections in this report. First, family and social class provide a longstanding context or frame of reference within which students make their HE decisions. Second, there are very significant gender differences in terms of HE subject choice and career aspiration. Third, attitudes towards subjects develop through a student's school life and these perceptions have an influence on post-16 choices.

It is clear that taking a degree enhances life income, although this has become less true in recent years, is less true for women and is less true for arts and humanities-based subjects. Indeed,

> "if students see studying for a degree as a vehicle for higher career earnings, they should choose their course of study carefully. Arts and humanities-based subjects in particular have a considerably smaller impact upon lifetime earnings than other subjects, and in the case of men the additional monetary benefits are not sufficient to cover the cost of attending university" (O'Leary & Sloane, 2005).

The potential impact of student fees is also addressed by Rolfe (2001) who reports HE lecturers' perceptions of students' motives as becoming increasingly "consumerist". In a small sample (66) of USA students, Montgomery (2004) found that about 70% cited "job opportunities" as being a major influence on their choice of subject and Byrne & Flood (2005) report a similar finding for UK accountancy students. A student and lecturer survey for the book industry reports that "by far the most common answer was to get a degree that leads to a well-paid job ..[and that]…the overwhelming message from the majority of students is that they are entering higher education for career reasons" (Open Books, undated). Ridley *et al* (2005) confirm this for Oxbridge students, with "career prospects" being ranked first in their influences.

Using First Destination Survey data from 3 cohorts of UK graduates, involving between 2,000 and 6,000 students in years 1985, 1990 and 1995, Chavalier (2002) raises the interesting question of regret, examining the extent to which students regret their HE subject choice after a few years. Surprisingly, compared with women, men are more prone to have regrets about their choice of degree subject and career. Chevalier explains this by suggesting that men choose their subjects less because of enjoyment and interest but more because of potential income generation. By contrast, women's choices are less affected by potential earning power and therefore less likely to bring disappointment (Montmarquette, Cannings, & Mahseredjian, 2002). This has obvious implications for the current research since it suggests that males and females respond to different stimuli concerning HE subject choice.

Women are more strongly orientated towards subjects which lead to lower-paid careers (Siann & Callaghan, 2001; van de Werfhorst, Sullivan, & Cheung, 2003), although they also choose medicine and law (high-paid careers) because of human-interest rather than high income (Pauline Lightbody, Siann, Tait, & Walsh, 1997). Lightbody & Durndell (1996) make the point that a deficit model to explain female career choice is flawed. The failure of females to choose science, engineering and technical careers does not reflect a failing or weakness on their part: "it seems more probable that female school leavers know exactly what they want, and until careers in the physical sciences and technology come some distance towards meeting these requirements the situation is unlikely to change" (p. 144).

Career aspiration, perceived or more formal, influences both students and their teachers throughout the secondary school. FitzGibbon (1999) looked at the processes by which students choose to take mathematics and sciences at A Level. She developed the concept of "pulling power" to describe those mathematics departments (and, therefore, schools) which attracted more than the usual number of students into A Level mathematics.

> "For students who had been in schools or colleges with strong Pulling Power and had themselves included some mathematics-science subjects in their A-level choices (i.e., some of whom were possibly 'recruits'), it was found that both their reported quality of life and expected earnings were higher than similar students not 'recruited' into mathematics- science A-level subjects"(Fitz-Gibbon, 1999, p.229)

There is no doubt that career prospects and the desire to "get a good job" figure large in children's preferences for school subjects. In their major report, Galton, Gray and Rudduck report that "children generally worked hard because they found the subject matter interesting or, alternatively, because they wanted to succeed at school to get a good job. … Pupils worked hard because they were clear that doing so was a necessary if they were to succeed as adults" (Galton, Gray, & Rudduck, 2003, p.52).

Role of gender

This section deals with the influence of gender on perceptions and choices throughout school life, from primary school to a level and beyond.

Since there are gender contrasts within most of the themes chosen to structure this report, overlap between sections is unavoidable. To reduce repetition, therefore, some gender-related issues are addressed in other sections; for example the previous one on careers, income and employment. There is an inevitable degree or arbitrariness.

There is no doubt that gender continues to play an important role in educational choices at all levels, but things are changing. Boys' preferences for "masculine" subjects and girls for "feminine" subjects have been explored and reported for decades, often with a focus on the failure of girls to engage with science, engineering and technical (SET) subjects (2001). This under-representation by females in SET courses through secondary and tertiary education (with obvious career implications) persists, but the causes and explanations change. Siann and Gallaghan (2001) argue that the 'female deficit' model of explanation is flawed: the 'girls and science' problem is nothing to do with the girls and everything to do with the science. They suggest that the numerous schemes to "eradicate such hypothesised barriers" (p. 88) (such as introducing female role models, enriching girls' SET experiences, modifying SET curricula and sensitising teachers to gender issues) have, in the main, not succeeded. These measures are also

pointless if they fail to address the central issue: the nature of SET courses and careers, with their associated values and priorities.

Girls now out-perform boys at GCSE science (Francis, 2000), with choices at A Level continuing to be gender-biased along traditional lines, with more boys opting for physics and more girls for biology, with chemistry balanced (Osborne *et al.*, 2003). Compared with the (masculine) SET disciplines, geography is represented as a "feminine" subject (Colley & Comber, 2003), although science *per se* is neutral since the feminine biology balances the masculine physics. The arts, humanities and social sciences are traditionally represented as feminine at both school and HE levels (Chevalier, 2002; Francis, 2000; Jonsson, 1999).

Ashworth and Evans (2001) reported a teacher gender effect on degree subject choice:

> "There was some evidence of teacher effects: using a 0.10 significance level, men taught by [A level] female economics teachers were more likely to go on to do a degree in economics (particularly relative to science), and so were women who were taught by male teachers. However, much more interesting, we found that women taught by female economics teachers were less likely to go on to study economics at university (particularly with respect to business). This may be important; although women teachers attract female students to the subject at age 16, it seems that they provide information while teaching them that puts these women off further study" (p.317).

In the context of the Swedish education system, Jonsson (1999) discusses how boys enter a virtuous cycle of interest, socialisation and attainment in the SET subjects from the start of their school careers, thereby accumulating a 'comparative advantage' in those subjects and developing higher expectations of success. Students make subsequent educational choices rationally, based on anticipated attainment. For boys this 'comparative advantage' emerges with the SET subjects and for girls it develops with the arts and humanities. His rational choice model is based on sex-specific comparative advantages in a country where there are no gender differences in the level of educational attainment.

The importance of careers for educational choices has been noted above. Much research points to the conclusion that male choices are more influenced by economic factors (careers) and female ones by enjoyment of the subject or by wider social or family needs. Osborne *et al* (2003) note that girls tend to avoid sciences at A Level because they don't want to restrict their career choices to sciences. Montgomery (2004) found that the rhetoric of individualism (among USA students in a highly-selective liberal arts college) was applied differently by male and female students, the males allowing their choices to be constrained by economic forces and the females allowing it to be subordinated to the needs of family. Chevalier (2002) examined the impact of degree subject on career and income, finding that the UK gender wage gap (typically of 20%) can be explained largely by the string of educational decisions made by males and females that have resulted in females occupying lower-paid jobs.

Wikeley and Stables (1999) found that the introduction of the National Curriculum caused a reduction in gender difference and Stables (1996) found few gender differences in the factors that influence student educational choice.

Role of prior attainment, ability and personality traits

This section covers issues of ability and educational achievement which have long been reported as dominant influences on HE/career choices at 17+.

Prior attainment in relation to degree subject choice goes well beyond A Level grades. Indeed, since for most applicants their HE choices are made before A Levels are taken, it is clear that the link between the two is only indirect. Attainment prior to 16 years probably has a greater influence on degree subject choice than attainment and attitudes developed through the A Level years. It is this cumulative process of evolving perception and achievement that has the real effect on degree subject choice: and for most people that starts well before the age of 14 years.

It is clear that prior attainment is one of the most important influences on educational choice through secondary school and into HE (eg. Ashworth & Evans, 2001). It has several facets. First, given that important HE decisions are made before A Level results are achieved, there is the important distinction between students' perceptions of their abilities and aptitudes compared with their actual attainment. The same issues apply to choices made at 16+, and even 14+ years, but to a lesser degree (eg. Payne, 2003). Second, mutivariate analyses involving ability alongside gender, social class and self-image show a complex set of causal relationships (eg. Francis, 2000; van de Werfhorst *et al.*, 2003). Third, attainment has a strong influence on staying-on and HE decisions but it is less clear how it impacts directly on choice of HE subject (eg. Foskett & Hesketh, 1997).

Students abilities at GCSE, actual or perceived, comprise a major influence on choice of post-16 study (Foskett & Hemsley-Brown, 2001). Bachan (2004) shows how the perceived difficulty of economics by 16-year-old students (post-GCSE) is leading to a shift from that subject towards business studies at A Level. This student perception is confirmed by the actual GCSE results and "results provide further supportive evidence on the important role played by prior attainment at GCSE and mathematical ability in selecting economics over business studies at A Level". Many other authors report on the direct link between A Level choice and GCSE attainment (Harackiewicz, Barron, Tauer, Carter, & Elliot, 2000; Taylor, 1992).

The link between social class and educational attainment in the UK has remained intact for the past century and continues into the twenty-first century (van de Werfhorst *et al.*, 2003). It follows, therefore, than any analysis of the latest GCSE, AS and A Level results, by subject or otherwise, is bound to become an analysis of social class distribution by proxy. Van de Werfhorst *et al* show the complexity of the relationship between ability and subject choice through secondary and tertiary education, although their data only refer to people born in 1958. Their analyses show that:

> "attainment in humanities, science and social studies subjects at O Level/CSE [the forerunners of GCSE] have an independent effect on subject choice. Children who have obtained good grades in humanities subjects tend to choose the arts in university, and are relatively likely to avoid the technically-orientated subjects, such as engineering and science. Relatively high levels of attainment in science O levels and CSEs are associated with the choice of engineering and pure sciences at degree level. Conversely, good social studies results at 16+ are associated with the choice of social studies rather than technical subjects and the arts at degree level" (p. 55).

and

> "Ability also has a strong impact on subject choices at university. Children who were relatively good at reading compared to mathematics at the age of 11 were most likely to go into the arts and social studies. Those who were relatively good at mathematics chose engineering, the sciences, and medicine and law disproportionately often" (p. 59)

The concept of ability is so complex and controversial that most authors treat it as synonymous with attainment in formal assessments such as GCSE. Stables and Wikeley (1997) suggest that students making their GCSE choices in Year 9 tend to underestimate their own abilities and interests when assessing subject importance: this is even more significant since "subject liking is strongly connected to perceived ability and that career aspirations appear highly unstable at 13-15 years" (p. 402). Regardless of its definition, the influences on ability are so multifarious, stimulating some multivariate analyses. Van de Werfhorst *et al* (2003) also note that the family's impact on a student's ability/attainment also impacts on interest, according not only to the quality and quantity of family resources but also to their nature, cultural or economic.

Referring to A Level choices in 2001 and 2002, Bell *et al* (2005) note that A Level science specialists have high overall attainment at GCSE and that "one of the most striking features is the sheer numbers of different combinations of A Levels taken. A Level students have come to expect considerable choice and diversity in the overall course of studies" (p.399). A Levels are chosen with an eye on HE course admission requirements, although this increasing diversity would appear to favour those HE disciplines that have diverse requirements, unlike physics or engineering. Mansell and Hutchings (2005) chart the decline in GCSE, AS and A Level geography in recent years, noting that grades in geography tend to be

well above average. Other authors have suggested that both geography and the sciences are chosen by more-able students (Weeden, 2007).

Tomlinson and Macfarlane (1995) examined the profile of degree classes in UK universities in 1993 according to degree subject and gender, finding that females were awarded fewer first class degrees compared with males. The main explanation lies with subject choice: more firsts are awarded in science and technology and those subjects are preferred by males, compared with females.

Role of social class, family background, parents and peers

This section covers the influences of family and social class, long seen as critical influences on children's perceptions of curriculum subjects and on their career and HE choices.

Social class and family background have long been seen as major influences on students' educational choices, the majority of the research focusing on level of education, particularly aspirations to HE at 16+ years. However, there have been two large empirical studies of the social factors affecting degree subject choice (Bratti, 2006; van de Werfhorst *et al.*, 2003), both addressing issues of parental background, career trajectories and social class. Other studies which report on social class influences generally have narrower focuses (eg one or two disciplines) and/or smaller samples (eg Bachan, 2004; Thomson, 2005).

Van de Werfhorst *et al* (2003) developed a theoretical framework for investigating the social influences on subject choice through secondary and tertiary education. Their longitudinal study was based on data from the National Child Development Study, comprising the 13,245 people born in the week March 3-9 1958. Educational and career trajectories were tracked through monitoring at 6 points between 1958 and 1991. Social class of parents was represented as 6 categories, from professionals to unskilled manual workers, and a key facet of social class was "cultural capital" of the home. The school curriculum subjects were grouped into 3 categories: humanities (excluding geography); social sciences (excluding geography) and sciences (excluding geography but including geology). University degree disciplines were grouped into 6 categories: medicine & law; engineering; science; economics; social studies; arts ("including humanities"). Geography is not cited anywhere. Their analysis revealed a number of interesting relationships, particularly those linking reading and mathematical abilities in secondary school to degree choices. Social class correlates well with reading and maths abilities at 11 years and:

> "children who were relatively good at reading compared to mathematics at the age of 11 were most likely to go into the arts and social sciences. Those who were relatively good at mathematics chose engineering, the sciences, and medicine & law disproportionately often. Attainment at 16+ in humanities, science and social studies subjects were associated with choices of similar subjects at university" (p.59).

The "cultural capital" of the home had a strong influence on reading (over mathematical) ability and this in turn influenced later decisions:

> "comparative advantage in reading (at age 11 - the final year of primary school) retains its impact on subject choice in university, controlling for ability at age 16. This is an important finding, for it indicates that routes to types of study in university that lead to advantageous labour market opportunities - generally the social studies and the arts lead to worse prospects than, say, medicine or the sciences - are already shaped in primary school" (p. 55).

Although attainment in school is related both to social class and degree subject choice, van de Werfhorst *et al* (2003) report only one strong social class effect on degree choice: children of professional class were more likely to take medicine and law than were children of unskilled manual workers. They continue to analyse this "lack of social class effect on degree subject choice" (p.59) in relation to expanding UK HE provision.

Bratti (2006) looked at the relationships between social class and degree subject choices in the UK, using three categories of university discipline: medicine & law; quantitative subjects; and non-quantitative subjects. He examined the university-generated data for 1981-1991 and reports unambiguously that

there are no “statistically significant differences among social classes in the probability of enrolling in different subjects in the period 1981-1991” (p.27). This finding corresponds with that of van de Werfhorst *et al* (2003), perhaps confirming their explanation based on expanding HE participation. Similarly, in his study of student choices between economics and business studies, Bachan (2004) reports “minimum support for the notion that parental characteristics influence the choice of A Level in the present study”. Furthermore, there appears to be no social class effect on attainment in final degree marks at Cambridge University (Leman, 1999).

Although empirical research shows that any immediate and direct social class effect on HE subject choice at 17+ years is very small, it is clear that parents and home background exert an indirect influence on educational choices and attainment made through schooling, an effect that is subtle and contextual rather than explicit and occurring at a fixed point in time. Many authors describe this framework of expectation within which students make their educational choices. Ball *et al* (2001) refer to the tightness of the “framed field of reference”, where tightness of frame depends on a range of factors, especially the level of parental education. However, young people have a tendency to ignore or resist this frame. Other authors report on family influences. Gorard *et al* (1999) note the strong family effect on all transitions and educational trajectories in South Wales and Payne (2003) comments that parents “have a pervasive influence in shaping young people’s attitudes to education over a long period of time, so that the broad direction of what they will do at 16 is simply taken for granted” (p.30). Parents also support decisions at different times, get information and provide contacts. The extent to which this framework of (unspoken?) expectation extends beyond school life to exert an influence on degree subject choice is unknown, although for students from middle-class families there is no reason to suppose it suddenly stops at 17 years: “Somewhat at odds with the emphasis upon new youth as characterised by open, flexible and contingent identity projects, families strongly frame students’ futures and especially inform their fear of failure in achieving a secure middle-class self” (Richards, 2005)

Richards (2005) also examines the importance of the frame of reference provided by family, suggesting that:

> “the trajectories taken by these [A Level] students cannot be understood only in terms of their negotiation of the school’s hierarchy of legitimacy. In situating their choices, and their judgements of what constitutes success and failure, the students’ families are crucial. Somewhat at odds with the emphasis upon new youth as characterised by open, flexible and contingent identity projects, families strongly frame students’ futures and especially inform their fear of failure in achieving a secure middle-class self.” (p.616).

Payne (2003) also suggests that parents are “probably the most important source of advice and help when decisions about post-16 routes have to be taken” (p.2), although Delgety and Coll (2004) report the decline of this influence through secondary school, and Foskett *et al* (2004) show that parents of high socio-economic status are more influential than those of low SES. Girls are more influenced by parents than are boys (Dawson & O'Connor, 1991).

Ridley *et al* (Ridley *et al.*, 2005) report on changes in the parent/social class effect between 1998 and 2004 in relation to Oxbridge applications, so that by 2004: “parental qualifications were no longer related to whether students were applying” (p.9).

Many authors report negligible influence by parents on degree subject choice. Montgomery (2004) highlights the “rhetoric of individualism” among USA students and Byrne & Flood (2005) show how (UK) parents influence the decision to study in HE but not the choice of subject (economics). In the context of 447 Saudi Arabian undergraduates, Aldosary and Assaf (1996) report that “peer and family pressure has little influence on the students in selecting their majors” (p.1).

Peer influences are complex and much-studied in relation to social functioning through the childhood years, and they certainly have some influence the staying-on decision (Payne, 2003) and the choice of post-16 college, although it is all a matter of degree. Peers appear to have negligible influence on choice of degree subject and Payne (2002) shows that “at the actual point of choice, very few young people say that they take a particular route in order to do the same as their friends” (p.17). Other authors report the same small effect (Foskett & Hesketh, 1997; Furlong, 1993; Keys *et al.*, 2004).

Social class and parental background figure large in the many evaluations and research reports of recent initiatives to encourage staying on at 16+ years and widening participation in HE in the UK. Most of these deal with macro-scale data, rather than degree subject, and most show the decline in social class influence in recent years (Hatt, Baxter, & Tate, 2005; Hemsley-Brown, 1999; Hutchings & Archer, 2001; Knox, 2005; Morris & Rutt, 2005). In their evaluation of the Aimhigher initiative, Hatt *et al* (2005) note how interventions such as Aimhigher are closing the gap between the advantaged and disadvantaged students in relation to the capacity of their parents to encourage HE application. Lack of parental HE experience has less effect than it did 10 years ago. Similarly, Morris and Rutt (2005) are optimistic about Aimhigher, although fear of debt and dissatisfaction with the current (A Level) course continue to have negative influences on students from disadvantaged areas who do not intend to apply to HE, despite being well qualified to do so.

In the USA HE context, Davies and Guppy (1997) make the interesting point that, with increasing HE participation levels, " much of the system's sorting function has been moved to higher education. … At least two axes of stratification dissect the post-secondary system: the hierarchy of institutions of differing prestige and selectivity, and the stratification among fields of study" (p.1418).

It seems, at least for the Swedish educational context, that the influence of social class on decisions made on entering HE is greatest when the educational pathways have been unusual or indirect (Breen & Jonsson, 2000).

HE-focus: perceptions of the GEES disciplines workload, teaching and learning

This section is orientated towards the HE issues as opposed to school ones. It and deals with perceptions of GEES disciplines held by HE students, school pupils and others beyond.

HE perceptions on the nature of geography

Philosophy of geography has generated a huge literature over the decades and centuries. Examples of the more recent include writings by Thrift (2002) and Pitman (2005), both of which have stimulated debate in journals and newsletters. Making strong use of the human/physical dichotomy Thrift optimistically points to a number of recent "successes" and "problems" for geography and identifies "keeping geography buoyant in the schools" (p.295) as one of the main problems. Turner (2002) argues against fragmentation and challenges Thrift's physical/human division. Ferguson (2003) also disagrees with Thrift's human/physical analysis, pointing out that the most influential papers by geographers have been published in multi-disciplinary journals, especially for so-called physical geographers. In his response to Thrift, Clifford (2002) is deeply pessimistic, arguing in favour of an enhanced discipline of geography: "The failure to collectively seek a united front is possibly of more importance in the failure of the discipline to prosper its image or defend its territory than any lack of internal philosophical or epistemological common ground" (p. 434).

The issues raised by Pitman (2005) are of more direct relevance for the GEES project because they deal with the relationship between geography and Earth System Science. He argues that geography as a discipline has a more secure future if it becomes the 'lead discipline' in the emerging ESS which he portrays as a 'super-discipline'. He addresses the links between geography and science, but makes no comment on school curricula. Although he identifies the range of ESS constituent disciplines as "mathematics, physics, chemistry, biology, economics, politics, law, statistics and computer science" (p. 145), he fails to address the implications of this for the school curriculum and teacher training. His tone is territorial in favour of geography and, by implication, against others: "If geography does not take leadership in this arena [ESS], it will not be long before other disciplines fully take this opportunity from us and Earth System Science will continue to develop in parallel with geography - at our expense" (p. 146).

Johnston (2006) takes issue, most vehemently, with many of Pitman's remarks, suggesting that "geographers, collectively if not individually, are both paranoid and have an inferiority complex" (p.10).

He argues that the oft-cited monopoly possessed by geographers to engage in synthesis is misplaced and that geography has a clear role within the academic division of labour, worked out variously according to local cultural and historical contexts.

Finally, Gregson (2003) is pessimistic about any debate about the nature and future of academic geography since, she claims, we now occupy a post-discipline world. Debate which hinges around discrete disciplines is bound to generate territorial behaviour, "disciplinary parochialism and imperialism" (p. 60) and to focus on material items such as jobs, buildings and facilities rather than ideas, which can exist and prosper independent of any specific discipline.

HE perceptions of school/university links

The large literature on student choices at 16+ include many references to various types of school/HE link, especially the growing importance of summer schools and the value of discussions between 17+ students and HE tutors (Keys *et al.*, 2004; Morris & Rutt, 2005). There are few reports of GEES-specific liaison schemes.

There is a big gap between school and HE geography, in terms of student preparation and expectation, teaching approaches, subject matter and the involvement of HE academics in school geography. Brown and Smith (2000) chart the history of the divide from the 1960s, showing its widening from the 1980s with the emergence of postmodernism in universities and "issues geography" in schools, followed by the various versions of the National Curriculum which enhanced the divorce. They have some optimistic conclusions, including the fact that PGCE geography specialists considered their own HE experiences to be the most influential factors in their own decisions to enter teaching.

Stannard (2004) also analyses the issues at length, referring to the isolation of HE geography from school geography, arising from: RAE imperatives; the ending of formal participation by HE in school curricula and syllabuses; the major conceptual changes in HE geography compared with the relative stability of school curricula; the growth of HE geography specialisms which are increasingly distant from school geography; the marked contrasts in pedagogy; and the widely-held view that schools are no longer amenable to HE input.

School/university links are widely perceived as being critical for the success or even continuation of HE geography. Clifford (2002) sees a "divorce between the subject in the university and the schools .. where .. geography is fast disappearing into environmental or humanities course programmes. One thing on which we can all agree: this will be the death of large-scale geography in the universities" (p. 435). Bonnett (2003) also notes the isolation of HE geography, not just from schools, and calls for greater school/university links in geography. Thrift (2002) presents the same perspective, suggesting that geography "has been diluted by environmental studies or has to compete with other disciplines like history for the same slot .. [and]…without producing geography in schools, there will be no geography" (p. 296). In Australia Cranby (2001) comments on the misconceptions of school geography held by HE geographers, at least in relation to HE recruitment.

The school/HE gap is investigated in contexts other than geography. Siann and Gallaghan (2001) examined gender variation in recruitment to SET (science, engineering, technical) degree courses, concluding that females avoided HE SET programmes not because of any fundamental deficit in their make-up: more the fact that SET-related careers are perceived as having no human interest elements. Using data from first year science undergraduates in the University of Ulster, Lowe and Cook (2003) comment on the lack of awareness of HE academics concerning school teaching and show that first year undergraduate students succeed most often when there is a close match between school and university teaching approaches.

Many HE authors call for greater liaison between school and university geographers, often in the context of declining HE recruitment, at least in terms of quality. Imrie and Cowling (2006) describe a collaborative and liaison project involving Royal Holloway and a local secondary school. Various activities were established, including 1-day workshops and courses on research skills and report writing. They also reported on a west-London project designed to link primary, secondary and tertiary sectors in

the context of geography. Recruitment to HE is not presented as the main motive of the RH partnership, although that is the main theme of the closing paragraph.

Recruitment to undergraduate geography programmes is variously described as having a "bleak outlook" (Stannard, 2004), requiring the use of 'clearing' (Clifford, 2002) or offering fewer degree courses (R. Gardner & Craig, 2001). Croot and Chalkley (1999) commented on the lack of research into HE geography recruitment. The recruitment outlook is perceived as being uncertain, with variable levels of optimism and pessimism among authors.

Research reviews

This section mentions some of the larger literature reviews of the last few years.

Lord & Johnson (2004; 2005) provide annual literature reviews of children's changing perceptions of National Curriculum subjects. Osborne, Simon & Collins (2003) review the literature on school pupils' attitudes to science over the past 20 years, noting the recurrence of influences such as gender, perceived difficulty, learning activities, teachers and the wider society.

Much attention is given to choices at post-16, most addressing HE/work contrasts, widening participation and staying-on rates in post-compulsory education. One of the main reviews of this research is Payne (2003) who covers decision-making theory (3 models: p. 11-14), careers issues and attitudes to school and HE.

Other large reports combine major reviews with empirical research, notably into staying-on rates and educational choices at 14+ and 16+ (eg. Foskett *et al.*, 2004; Morris & Rutt, 2005; Payne, 2002, 2003)

The literature on educational transitions, including school transfer, is enormous and much is peripheral to the current project. Some include substantial literature reviews (eg. Morrison, Pell, & Galton, 2000)

Simons Lowe & Stout (undated) present a major literature review for accountancy which covers 21 articles on factors influencing students' choice of accountancy as a major (USA). They conclude that these factors fall into 2 distinct groups: student expectations and student background or experience. The difference in focus is clear, with one looking forward and the other looking back. The former include all matters concerning careers (income, satisfaction, security, flexibility etc) and the anticipated HE experience. The latter include attainment, personality traits, social class, family background, aptitude for the subject, enjoyment of the subject, teachers, etc. The authors attempt to assess the relative importance of each factor, concluding that earnings and employment opportunities rank very highly.

Information sources

This section addresses the main sources of information that students use when making their HE choices at 17+.

It is difficult to unravel the various influences on students' educational choices from their sources of information. Many authors comment on the sources of information used by students in making their HE decisions, but most are merely lists derived from the students themselves, or sometimes provided by teachers. Very little (no?) empirical research has been undertaken on this topic. Writing from the Australian HE marketing perspective, James (2002) concludes that "many school-leavers do not have well-informed intentions and aspirations" (p.1): it appears that the same is true for the UK context, but it is all relative. The sources identified by various participants are not unexpected: teachers, careers teachers (Morris, 2004), university visits, visiting HE speakers, internet, parents, Personal Advisers (Connexions), friends. Foskett and Hesketh (1997) identified 11 distinct sources (p.310) and Keys *et al* (2004) similarly generate lists (Section 8), but these merge into influencing factors. Morris & Rutt (2005) single out teachers and careers advisors and university visits as key sources. For geography, the provision of basic information is high on the agenda of RGS/IBG (Royal Geographical Society with Institute of British Geographers, 2001).

Ongoing research projects

The following organisations were contacted, but none reported any major activity in this field: Royal Geographical Society with Institute of British Geographers, The Geological Society, Geographical Association, Earth Science Teachers' Association. Responses elicited a variety of replies from individuals, most reporting small-scale research which is mentioned elsewhere in this report. Carl Griffin & John Canning at Southampton Languages and Area Studies HE Subject Centre had produced an online survey of "changing conceptions of geography" for their own undergraduates, but no results are yet forthcoming. Alan Mariott is currently working on issues of transition from A Level to degree level geography on behalf of the Geographical Association, again with no results to date.

Options for action

The GEES disciplines

1. How do KS3/4/5 (geography and science?) teachers perceive the GEES disciplines in relation to their own subjects and how do their perceptions influence the advice they give pupils on their GCSE/AS/A2 choices? This could be addressed through a convenience sample of 30 to 50 teachers, using short questionnaires followed by selected interviews based on questionnaire data.
2. Might it be useful to identify educational pathways which link school subject choices at 14+, 16+ and 17+ to the various GEES disciplines? This would become an open net, with many departures from the GEES enclosure as, for example, students studying geography/biology/maths make non-GEES degree choices at 17+. This might also allow the identification of barriers to continuity and progress: do students find their degree choices restricted by their A Level choices?

Evolving perceptions, conceptions, attitudes, interest and subject choice through primary and secondary school

3. Is there a relationship between the five types of 'choice trajectory' (Cleaves, 2005) and GEES-related choices through secondary school, and, if so, what are the causes of these differences and how can this knowledge be used to enhance career and HE advice for students? This is all about the stability of student perceptions and their relative openness to new opportunities. This could become a major research focus since it addresses one of the most significant elements in the main report, viz. evolving student perceptions through secondary school. One approach would involve interviews with 100 randomly-selected pupils at 11+, 14+, 16+ and 17+ (25 of each age). Alternative approaches might focus on several contrasting groups, such as GEES students at 16+ and 17+ compared with non-GEES students. If Cleave's various trajectories could be linked to GEES-related choices, that would illuminate the situation considerably.
4. What assumptions and expectations do students hold (or accommodate) when expressing their own perceptions of GEES-related topics, subjects and educational courses? This would be a piece of psychological research and might take us beyond the scope of the present project. It might involve the research techniques of the psychologist and would shed light on some of the hidden influences on students' educational decisions.
5. How and why do students' perceptions of GEES subjects and topics change through their school careers? This could be a simple survey of perceptions, attitudes and interests across a range of secondary school students, regardless of career and HE aspirations.
6. What are the key points at which students are most receptive to GEES-related HE information and guidance? This could be approached directly through pupil interviews, indirectly through teacher interviews or retrospectively through interviews with GEES undergraduates.
7. What is the nature of students' conceptualisations of GEES disciplines and topics and how do these relate to the science/non-science divide? This could be developed as a substantial probe

for students across the 11-18 years age range and could focus not just on the GEES subjects but also on specific topics within those subjects.

8. How do science teachers perceive the geoscience elements of NC science?
9. How is GEES-related situational interest at ages 14 to 18 transformed into GEES-related individual interest by 17+? (Trend, 2005). This could be a substantial piece of research, involving a range of research strategies, including questionnaires and interviews, designed to identify learning activities across GEES subjects which lead most readily to secure individual interest in GEES discipline/s by 17+.
10. To what extent do students' perceptions of the GEES subjects reflect Ramsden's (Ramsden, 1998) five summary statements and how might this knowledge suggest ways in which teachers and others can enhance students' experiences of GEES subjects? These five issues are as follows
    - science is perceived as difficult and often irrelevant to pupils' lives; *[is GEES?]*
    - science is perceived as causing social and environmental problems; *[is GEES?]*
    - science is more attractive to boys than to girls; *[is GEES?]*
    - pupil interest in science declines through secondary school (11 to 16 years) and; *[does it for GEES?]*
    - physical sciences are perceived by children in a more negative way than are the biological sciences. *[where does GEES fit in?]*

Influence of schools, teachers and careers/HE advisors

11. How much importance do KS2 teachers place on GEES subjects and what is the influence of KS2 teachers' perceptions on students' evolving attitudes towards GEES topics and subjects? It is easy to under-estimate the role of primary teachers in shaping students' perceptions of GEES and, therefore, their HE and career aspirations. This would require a systematic survey of primary teacher attitudes.
12. How do secondary teachers perceive the GEES disciplines at HE, including the difference between environmental studies and environmental science, and how do these perceptions vary between categories of teacher (eg careers, science, geography, Head of KS4, Head of Post-16)? This might involve the development of research instruments to probe teachers' attitudes and values towards GEES which will take us beyond their own perceptions.
13. What is the scale of teacher influence on GEES-related choices at 16+ and 17+ compared with other influences, such as parents, social class, enjoyment and prior attainment?
14. To what extent are teachers well-informed about GEES degree courses and are some better informed than others?
15. To what extent are students' GEES-related choices at 14+, 16+ and 18+ influenced by their enjoyment of the subject/s? This would form part of a wider study of students' perceptions of the influencing factors.
16. How is the school/HE divide perceived by GEES-related teachers (eg geography and science) and how does it influence the careers/HE advice they give to students?
17. How do teachers describe and explain students' HE decisions at 16+ and 17+?
18. What messages about GEES at HE do pupils receive through the geography and science curricula at KS3 and KS4?
19. To what extent do students identify school-based GEES mentors, who are these mentors and what is their influence on choices? This would form part of a wider study of students' perceptions of the influencing factors and could be tackled via both students and teachers. It might be wise to ask GEES (and non-GEES) undergraduates to reflect on their previous influences.
20. How does GEES degree recruitment vary according to students' secondary school backgrounds in terms of age range, (11-16, 11-18, post-16), gender, selective, state, independent? This might involve the analysis of existing data (?) or a stratified sample of (c200) 2006 UCAS applicants.
21. What has been the impact of Personal Advisers and other elements of the Connexions Programme on GEES degree recruitment? This would be part of a wider study of undergraduates' perceptions of influences on their choices.
22. To what extent does recruitment to GEES-related subjects at 14+ and 16+ vary between schools and what are the explanations for variation? This might be a study similar to that by Carol Fitz-

Gibbon (1999) who identified some schools as having strong “pulling power” in mathematics and science.

23. How does the provision of more information concerning GEES-based careers to 14+ students influence their subsequent educational choices? This would ideally be an intervention study, with participants chosen to receive enhanced support, with a control group for comparison.

Perceptions of relevance to career, income and employability

24. How do 14+, 16+ and 17+ students perceive the relative importance of career and income opportunities compared with other factors such as career satisfaction, freedom and family requirements? Given the pivotal influence of career opportunity for HE subject choice shown in the research literature, this would be an important aspect of the GEES project. Given that choices are based essentially on perceptions, it would focus on student perceptions of GEES career opportunities (rather than any reality) and might be part of a wider study of perception. This would require a good-sized (200?) questionnaire sample, ideally randomly derived, followed by structured interviews with selected respondents. Gender contrasts and social class could also be probed, given their role in previous research findings. Parallel studies of teachers’ and parents’ perceptions would also illuminate the decision-making process.
25. How do students at 14+, 16+ and 17+ perceive the GEES disciplines in terms of their “usefulness” ?
26. What is the nature of current GEES-orientated careers advice? This could focus on various scales, from school through to national provision and policy and could involve scrutiny of documents as well as questionnaires and interviews.
27. What is the nature, origin and extent of current (GEES and non-GEES?) undergraduates’ regrets concerning degree subject choice?

Role of gender

28. To what extent does gender influence GEES-related choices at 14+. 16+ and 17+ (HE)? This would be part of a wider survey of student perceptions of influences.
29. What is the relationship between gender, HE subject choice and career aspiration? This might be best approached via GEES and non-GEES undergraduates.
30. Does teacher gender have any influence on students’ educational choices at 14+, 16+ and 17+?
31. Is their any gender difference in relation to GEES-based career-related educational choices? Are males more influenced by career and income considerations, compared with females, and, if so, how does this impact on GEES-related choices? This might focus on both GEES and non-GEES undergraduates in order to probe gender differences and contrasts between disciplines. It would be a major study with implications across undergraduate recruitment.

Role of prior attainment, ability and personality traits

32. What is the statistical relationship between educational attainment at 11+ and 14+ compared with GEES degree recruitment?
33. To what extent is prior attainment an influence on GEES-related choices at 16+ and 17+ (HE) and which school subjects are most relevant?
34. To what extent is perceived ability an influence on choice at 16+ and 17+ (HE) and which school subjects are most relevant?
35. What are the relationships between GEES-related choices and relative advantage in mathematics or reading at age 11+? This study would build on the findings of van de Werfhorst *et al* (2003) and would focus on students currently aged 18 or 19 and would require their Key Stage 2 SAT attainment scores in maths and English and perhaps other attainment data generated by secondary schools on transfer, such as CAT scores. It would be a fascinating study which would illuminate wider educational choices and successes, well beyond the GEES subjects.

Role of social class, family background, parents and peers

36. Is there any link between social class and recruitment to GEES disciplines? If so, what are the implications for recruitment policies?
37. What are the 'framing' social influences on students as they make educational choices at 16+ and 17+ years and how do these impact on GEES-related decisions? This would be a tricky study.
38. How do family perceptions of GEES disciplines influence students' educational choices at 14+, 16+ years and beyond?

HE-focus: perceptions of the GEES disciplines workload, teaching and learning

39. How do current GEES undergraduate students perceive the differences between HE and A level teaching and learning? What are the differences within the GEES disciplines?

HE-focus: perceptions of school/university links

40. What school/HE links best enhance students' perceptions of GEES disciplines?
41. How do current undergraduates perceive their own decision-making processes at 17+ years?
42. To what extent do current HE widening participation initiatives (eg Aimhigher) influence GEES-related decisions at 17+?
43. What strategies for encouraging HE participation are the most effective ones for the GEES disciplines?

Roger Trend
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Appendix C: Year 12 Questionnaire (Final Version)

You, your AS/A2 Level subjects and your future (Y12 Final Version)

- We need to find out what how students make choices about their careers.
- We are also interested in hearing your views about three particular subjects : geography, geology and environmental sciences.
- There are no right or wrong answers anywhere.
- Please be accurate and honest. Your answers will be totally confidential. Thank you very much for spending the time to help us with our research.

Please write you name and school/college here, and then tell us a few things about yourself	
Your name (you need not give this, but it will help)	Your school/college
Please circle one of these: female male	
What are/were the occupations of your parents/carers?	
Did any of your parents or carers go to university? (circle one) **yes no I do not know**	
If they did, what subject/s did they study? (circle one) **I do not know** **They studied**……	

For each question in Section 1, draw a circle round a number between 1 and 4. If you don't know circle 0.

Use the codes in this box ⟶

1	Not important at all
2	Limited importance
3	Fairly important
4	Very important
0	Don't Know

Section 1: your choice of subjects for study in Year 12, or first year of your A Level programme

Please tell us which subjects you are now studying at post-GCSE level: ignore any new GCSE subjects you are taking now. Write one subject on each line. Then say if you plan to take it beyond AS Level to A2 & tell us how important you think it might to be for your future career.

Name of subject	**Will you continue with it to A2 Level?**	**How important is it for your future career?**				
	yes no don't know	**1**	**2**	**3**	**4**	**0**
	yes no don't know	**1**	**2**	**3**	**4**	**0**
	yes no don't know	**1**	**2**	**3**	**4**	**0**
	yes no don't know	**1**	**2**	**3**	**4**	**0**
	yes no don't know	**1**	**2**	**3**	**4**	**0**
	yes no don't know	**1**	**2**	**3**	**4**	**0**
	yes no don't know	**1**	**2**	**3**	**4**	**0**

Please write in this box the reasons why you chose these subjects.

Please turn over.

Section 2: What do you think geography, geology and environmental science are all about?		
Please write down what you think these subjects are about. It is very important that you are honest and open. It is your perceptions that are of interest to us, not whether or not you actually know any 'right' or 'wrong' answers. You should only write in notes and key words: don't try to write long essays!		
Geography: What do you think this is all about?	What jobs do you think geographers do?	How do you know? Tick all that apply: ☐ School lessons or text books ☐ Posters / leaflets in classroom ☐ TV programme / film (please write the name of the programme/s below): ☐ Club or society ☐ Talking to friends or family ☐ I guessed! ☐ Other (please write what this is below)
Geology: What do you think this is all about?	What jobs do you think geologists do?	How do you know? Tick all that apply: ☐ School lessons or text books ☐ Posters / leaflets in classroom ☐ TV programme / film (please write the name of the programme/s below): ☐ Club or society ☐ Talking to friends or family ☐ I guessed! ☐ Other (please write what this is below)

Environmental Science: What do you think this is all about?	What jobs do you think environmental scientists do?	How do you know? Tick all that apply: ☐ School lessons or text books ☐ Posters / leaflets in classroom ☐ TV programme / film (please write the name of the programme/s below): ☐ Club or society ☐ Talking to friends or family ☐ I guessed! ☐ Other (please write what this is below)

Section 3: what are your interests in planet Earth and its people?
Please tell us in this box what things about planet Earth and its people really interest you. You might have no interest in these things at all. Please tell us, whatever your thoughts.

We are all influenced by different people and things. Please tell us what you think has influenced you in your A Level subject choices. Think carefully before you answer. There are no right or wrong answers.

For each question in Section 2, draw a circle round a number between 1 and 4. If you don't know circle 0. Use the codes in this box →

1	Not important at all
2	Limited importance
3	Fairly important
4	Very important
0	Don't Know

Section 4: what has influenced you in your A Level choices?

Please tell us how much each of these has influenced you with your A Level subject choices

	My parents or carers	**1**	**2**	**3**	**4**	**0**		My interest in the subject	**1**	**2**	**3**	**4**	**0**
	How well I did in GCSEs	**1**	**2**	**3**	**4**	**0**		My future career or job	**1**	**2**	**3**	**4**	**0**
	My Y11 subject teachers	**1**	**2**	**3**	**4**	**0**		My Y11 form tutor	**1**	**2**	**3**	**4**	**0**
	How much money I can earn in my career	**1**	**2**	**3**	**4**	**0**		My enjoyment of the subject	**1**	**2**	**3**	**4**	**0**
	Teachers in general	**1**	**2**	**3**	**4**	**0**		Television programmes / films	**1**	**2**	**3**	**4**	**0**
	My friends	**1**	**2**	**3**	**4**	**0**		What I want to study at university	**1**	**2**	**3**	**4**	**0**
	My brothers and/or sisters	**1**	**2**	**3**	**4**	**0**		Careers teacher or adviser	**1**	**2**	**3**	**4**	**0**

Please tell us about your possible plans for the next few years. There are no right or wrong answers.

Section 5: what career or job do you want to do when you finish your education?

Please tell us in this box what career or job you hope to do when you eventually leave school, college or university. Please also tell us how determined you are to follow that career.

My first choice of a career is:

I think I will like this career because:

I might also think about a career in:

I think I will like this career because:

Other possible careers I might think about are:

Now please tell us on a scale of 1 to 5 how determined (keen, convinced) you are to follow the first career you named above. 1 means that you are **not at all committed** and 5 means you are **absolutely determined** to follow that career

Please circle one number: **1** **2** **3** **4** **5**

Thank you very much for completing our questionnaire and all the best for your future career.