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Chapter 6:
The impact of science curriculum content on students' subject choices in post-compulsory schooling

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Abstract

This chapter considers the impact of school science experiences on students' post-compulsory subject choices. We view student choice as a 'dynamic process' rather than a rational decision made at a point in time. This process is influenced by a range of socio-cultural factors and students' developing sense of agency and identity. Using a combination of questionnaires and individual narrative interviews we examine how high school students (aged 16-18 years) in two schools in England reflect on the process of their subject choices. A distinctive feature of this study is that in these schools students are following a science course with a strong focus on socio-scientific issues and the nature of science, taught by teachers with a commitment and enthusiasm for such teaching. Consistent with previous studies, these students refer to a broad range of influences including perceptions of potential future careers, and school-related influences such as subject attainment, teacher quality, and enjoyment of the subject. Science curriculum content features as one influence amongst many within these students' reflections on subject choice. The distinctive focus on socio-scientific issues and the nature of science appears to encourage many students to consider pursuing science, but such choices need to align with other factors such as attainment and career aspiration. However, some students are ambivalent about, and in some cases dismissive of, such teaching. A minority of students in our sample talk of an early commitment to a science route through schooling. However, for other students, their reflections on the process of course choice are characterized by ongoing uncertainty and indecision.

Introduction

As elaborated in the Introduction to this book, the enrolment of appropriate numbers of students onto post-compulsory science courses is an issue of international concern, particularly in the physical sciences (European Commission, 2004; NSB, 2010). Additionally, attaining an equitable gender balance amongst those students choosing specific post-compulsory science courses has also been identified as a significant challenge. Previous studies have identified a wide range of factors influencing student choice. These include school-related factors such as teacher quality, attainment and enjoyment of the subject (Cleaves, 2005). In addition, broader social and cultural factors have also been shown to have a significant impact (Ball, 2000; Eccles, 2009; Foskett et al., 2008; Foskett & Hemsley-Brown, 2001). A recent study conducted in England suggests that a science course providing a strong emphasis on teaching about socio-scientific issues and the nature of science has resulted in increased uptake of science courses within post-compulsory schooling (Millar, 2010). Such courses might be affecting uptake by addressing issues known to turn students away from science such as the lack of relevance for their everyday lives (Murphy & Whitelegg, 2006). Therefore, a particular interest

of the study reported here is on the impact of teaching about socio-scientific issues and the nature of science, alongside other factors, on young people's subject choices within the years of compulsory schooling. Our focus on school students, and the choices that are formed within compulsory schooling, complements other contributions in this book that consider processes of choice beyond compulsory schooling and into higher education.

We do not see students' subject choice as a purely rational decision made at a particular point in time. Rather, we view 'choice' as a dynamic process, influenced by a wide range of socio-cultural factors (Foskett & Hemsley-Brown, 2001), and a student's developing sense of agency and identity (Archer et al., 2010); a view consistent with perspectives elaborated elsewhere in this book, and particularly in Chapter 2. Hence we focus on two research questions:

1. Through what processes do students come to be following (or not following) a science course within post-compulsory schooling?

2. How do school science experiences feature within students' accounts of these processes?

Viewing subject choice as a dynamic process has influenced the design of our study. We follow Hollway and Jefferson (2000) in using narrative techniques in discussing choices with students. This involves asking students to reflect on *how* they came to be following specific post-compulsory courses, thereby encouraging students to provide stories, or narrative accounts, of the process of choice. This approach can be contrasted with the common approach asking students *why* they made particular choices. This latter approach is likely to lead students to a clipped and overly rationalistic account of choice, with students likely to provide short, standard 'rehearsed answers' such as 'it's my best subject' (Rodd, Mujtaba, & Reiss, 2010).

Study design

Overview

We have collected data from two schools known to have a strong focus on the teaching of socio-scientific issues and the nature of science within compulsory schooling. This reflects our interest in the potential impact of such teaching on post-compulsory science choices. We have worked with these two schools as part of a three year longitudinal study of school experiences of curriculum reform[1]. Through interviews with teachers in these schools we knew that they had a strong commitment to the teaching of socio-scientific issues and the nature of science.

All students in the first year of post-compulsory[2] schooling (aged 16-17 years) were asked to complete an individual questionnaire probing how they came to be following their particular courses. Based on these responses a purposive sample of 22 students was invited to take part in an individual interview. This sample included those with a science course in their subject choices, and also those

[1] The Enactment and Impact of Science Education Reform (EISER) Project, http://www.education.leeds.ac.uk/research/projects/enactment-and-impact-of-science-education-reform-eiser

[2] Schooling is compulsory up to the age of 16 years in England. All students within compulsory schooling must study science. Thereafter students typically choose to either leave school or choose 4-5 subjects for further study. These may, or may not, include science subjects.

with no science course choices. In interviews students were encouraged to provide a narrative account of their experiences leading to specific subject choices.

Initial questionnaire

The main purposes of the initial questionnaire were: to identify suitable candidates for the interview sample; to characterise the population of Y12[3] students in these two schools in terms of gender and course choice. In open responses students stated how they had decided which courses to choose at AS-level[4], why they had chosen/not chosen science courses, and their career intentions. Students also indicated in closed response questions (using a five point Likert scale, from strongly disagree to strongly agree) their experiences of science lessons (e.g. interest, enjoyment, usefulness), influences on their choices of subject (e.g. attainment, curriculum content, teaching activities, teachers), and when they had first considered following science courses.

In each school the Head of Science was asked to distribute questionnaires to Y12 form tutors. These forms groups comprise 20-30 students, mixed in terms of gender, student attainment and course choices. Form groups are used to address administrative and pastoral issues within schools in England, typically in the first session of the day. Questionnaires were administered by tutors during this form tutor time for completion and return. The response rate is shown in Table 1. The gender balance within the questionnaire sample is roughly equal (49% female). Non-responses were the result of student absences on the day of completion and tutors not conducting or returning questionnaires to the Head of Science. Since the bulk of missing responses are from missing form groups, and form groups are mixed sets of students, we have no reason to expect our sample to be significantly unrepresentative of the student population in these schools.

	Questionnaire sample	**Y12 Student population[5]**	**Response rate %**
School A	35	53	66
School B	76	135	56
TOTAL	**111**	**188**	**59**

Table 1 Response rate for the student questionnaire

[3] The years of compulsory schooling run from Y7-Y11, followed by two years of post-compulsory schooling from Y12-Y13.

[4] Typically, students complete 3-5 courses in Y12. These courses are called 'AS-levels'. Students then continue with 3-4 of these courses to full 'A-levels' in Y13.

[5] Based on school reports, cross-referenced with government and Ofsted data. Ofsted is the official organisation in charge of schools' inspections in England. It publishes periodic inspection reports for each school in England.

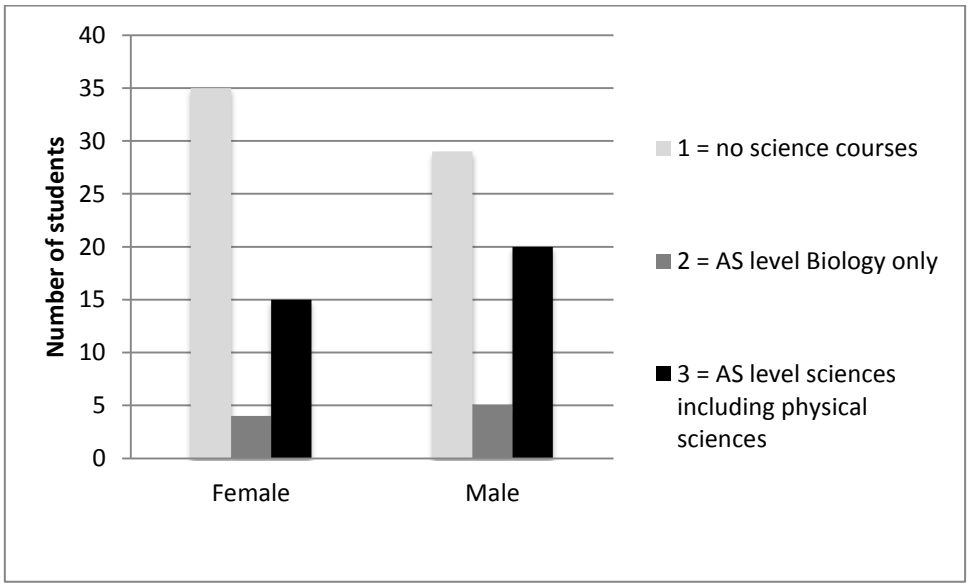
Interviews

Based on questionnaire responses we identified 22 students to invite to take part in a 20-30 minute interview. Within this sample we ensured a roughly equal proportion of science choosers (10) and non-science choosers (12). We oversampled for female students (15) since the focus of the IRIS study as a whole is on female students' experiences of the sciences. Each interview was conducted by one of the chapter authors or a third researcher[6].

As discussed earlier we aimed to encourage students to provide narrative accounts of how they had come to make their subject choices. To do so we divided the interview into three sections. The first part of the interview focused on the student's main narrative through the open question: "How is that you came to be following these courses in Y12?" This was followed by a series of probing questions covering topics already included in the questionnaires: school experience over time; school science curriculum, and discussions about socio-scientific issues in particular; and factors that might have influenced the student's decision, such as friends or school grades. In the final section of the interview the student was offered the chance to add new information and to comment on a brief summary of the interview provided by the interviewer.

Questionnaire responses

Figure 1 shows the number of male and female students that included science courses in their AS course choices. Our focus here is on traditional, high status science courses within England. Thus, for this analysis 'science' courses are either AS Physics, AS Chemistry or AS Biology. Students who include science-related courses such as AS Psychology or BTEC[7] Forensic Sciences in their course choices are categorised here as 'non-science' students. Most of these science-choosing students also included non-science courses within their choices.



[6] We thank our colleague Keith Bradley for his support in conducting these interviews.
[7] BTECs are vocationally-oriented qualifications.

Figure 1 Number of male/female students choosing science courses[8]

In this sample female students are underrepresented within science course choosers, as compared with male students Overall, 35% of female students are science choosers, compared to 47% of male students. Of those students that choose science courses, 15/19 (79%) female students include physics and/or chemistry courses, compared to 20/25 (80%) male students.

The questionnaire asked students to indicate, on a 5-point scale, the extent to which they agree that specific features of school science lesson activities had encouraged them to consider choosing science courses at AS-level. Below we present data for two of these features of science lessons: 'having discussions about socio-scientific issues' and 'learning facts'.

Figure 2 shows the percentage of science choosers, and non-science choosers, who agreed/disagreed with the statement 'having discussions in science lessons about ethical issues like genetic testing, abortion, mobile phone masts, energy resources, pollution of climate change, encouraged you (or would have encouraged you) to choose science courses at AS-level'.

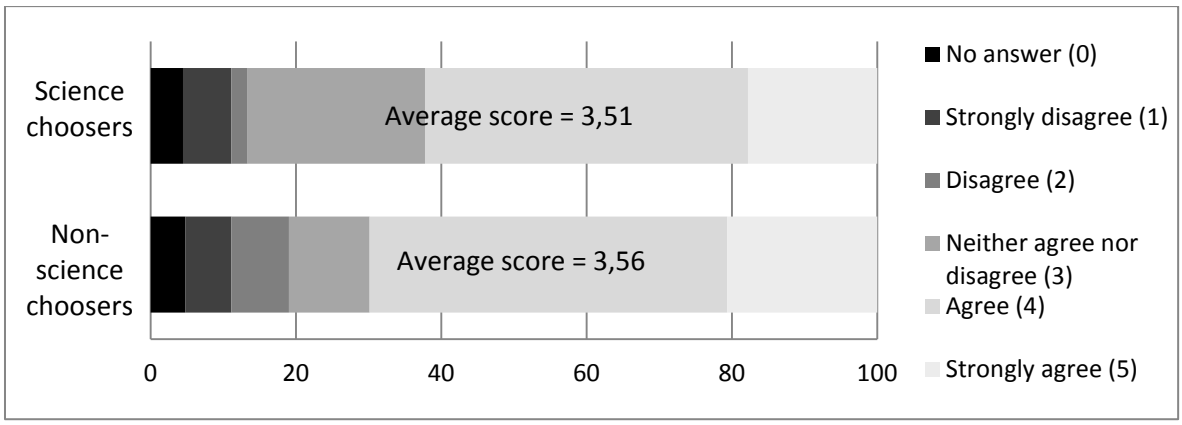


Figure 2 Percentage of science choosers, and non-science choosers, indicating that having discussions about social and/or ethical issues encouraged, or would have encouraged them to choose AS-level science courses. (N=111 students)

Overall, there is little difference between these two groups. For example, within science-choosers 65% of students providing a response agree or strongly agree that such activities encouraged them to choose science; within non-science choosers 73% of students agree or strongly agree that such activities had, or would had, encouraged them to consider choosing a science at AS-level.

Figure 3 shows the percentage of science choosers, and non-science choosers, who agreed/disagreed with the statement 'learning science facts in science lessons, encouraged you (or would have encouraged you) to choose science courses at AS-level'.

[8] Female n =54; Male n = 54. Data on course selection was not available for 3 male students.

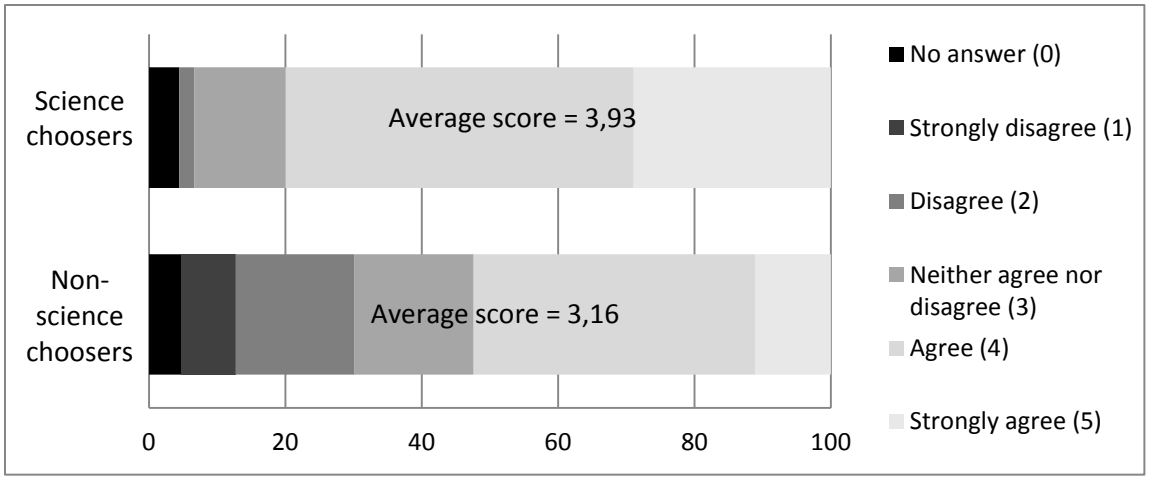


Figure 3 Percentage of science choosers, and non-science choosers, indicating that learning science facts encouraged them to choose AS-level science courses. N=111

It might be expected that science-choosers are more encouraged to follow science courses as a result of learning science facts than non-science choosers. This is indeed the case. Figure 3 shows that amongst science-choosers providing a response 84% agree or strongly agree that learning science facts had encouraged them to choose science. However, within non-science choosers only 55% agree or strongly agree that learning science facts had encouraged them to consider choosing a science at AS-level.

Overall, it appears that, on the basis of this self-reporting of impact, the inclusion of teaching and learning about socio-scientific issues such as the dangers of mobile phone masts, ethical issues related to genetic testing, and climate change within the school science curriculum has had a positive impact on encouraging students to choose, or consider choosing, science courses beyond post-compulsory education. However, science choosers indicate that learning science facts had a more positive impact on their choice (84% agree or strongly agree), compared to having discussions about socio-scientific issues (65%). By contrast, non-science choosers indicate that learning science facts had a *less* positive impact on their choice (55% agree or strongly agree), compared to having discussions about socio-scientific issues (73%).

Choice processes across the interview sample

In an initial analysis we attempted to use the categories reported by Cleaves (2005) to characterise the choice trajectories of the 22 students in our interview sample. However, these categories were not directly applicable to our data for two reasons. Firstly, Cleaves employed a longitudinal methodology to capture the changing nature of students' perspectives on choice over time. However, in our interviews students provide a single, retrospective account of the choice process. Hence it possible that the students offered overly rationalised explanations of their trajectories to account for their present choice of subjects (see Chapter 2). Secondly, we found that two of the Cleaves trajectories (directed and multiple projections) could be clearly attributed to some of the student interview accounts. However, the other three categories were often difficult to assign given our interview data. As a result, we reconfigured the Cleaves trajectories to focus more on the interplay between career and subject/topics as the main drive for the students´ choices – issues well represented in our interview data. Table 2 summarises these reconfigured categories, and the

outcome of coding for the 22 students in our interview sample. The range of trajectories shown in Table 2 is comparable with that reported for the 69 students in Cleaves's original study. In particular, we find, consistent with Cleaves, that many students do not have a clear, early focus on a specific subject pathway.

Trajectory	**Reconfigured definition**	**Main drivers for choice**	**Male**	**Female**	**Science**	**Non-Science**
Directed	A clear commitment to a specific career choice, usually over several years. Choice of subjects is determined by this career orientation. These students typically show high attainment in their subjects of choice.	Mostly career oriented	2	2	1	3
Multiple projection	These students change future career plans several times, often quite radically. Many are high attaining in most school subjects, and have broad interests.	Mostly career oriented	1	2	1	2
Partially resolved	Similar to *Directed* students but with a particular topic/subject as the stable theme over several years, rather than a particular career. They often choose specific AS-level subjects because they have enjoyed them in the past.	Topic/subject oriented	2	4	4	2
Funnelling Identifier	Starting with a broad area of interest, choices are narrowed down over time (as opposed to the more dramatic changes encountered in *Multiple Projection*). These students usually provide a detailed account of the process of selection which might include external advice, exam results and growing knowledge about potential future jobs.	Career oriented	1	3	1	3
Precipitating	These students usually talk about making a choice as a result of a particular incident, rather than as a process (as in *Funnelling Identifier*). They may have given little thought to future career/study plans, or have considered different options, and remain uncommitted to a specific path.	Both topic/subject and career oriented	1	4	3	2
TOTAL			**7**	**15**	**10**	**12**

Table 2 Categorisation of interview sample using reconfigured Cleaves trajectories.

Choice narratives: Two cases

Here we provide details of how two students talked about the process of course choice and the impact of school science activities on this process. These two students provide contrasting cases in terms of: the student's response to the teaching of socio-scientific issues; the development of the choice process over time. We have selected two science-choosers to focus on the differences that exist, in terms of trajectories, among students who choose to take science subjects in post-compulsory education.

Claire[9]: "Well, it was always picking between art or science"

Claire attained A-grades[10] on her science courses at the end of compulsory schooling. She chose four AS-levels: Biology, Physics, Psychology and History. Claire´s trajectory of choice is most closely categorised as 'precipitating' according to Cleaves´s categories (Table 2). More specifically, in Claire´s case, the trajectory of choice shows early subject enjoyment with on-going career uncertainty.

Claire refers to her experiences of school subjects and how these have influenced her AS-level course choices:

> *I've always enjoyed the science subjects*
>
> *I like biology anyway, and I find that an interesting subject anyway, and I like the stuff about life on earth and animals and stuff. And I think that's partly why I wanted to do physics as well because it was like the solar system. We're not actually doing much about that but I found that sort of thing interesting.*

Her references to the influence of school science experiences on course choices reflect a trajectory of early and ongoing enjoyment of school science, and an early inclination to choose sciences at AS-level. However, later in the interview, this choice trajectory on science is allied with a similar choice trajectory for non-science subjects:

> *Well it was always picking between art or science. I could have done the art/English side of it, or it was the science, more science and the mathematical side of it.*

Overall, Claire has been considering both routes for post-compulsory choices – she has enjoyed a broad range of school subjects. Her resolution of these considerations is related to two key issues: career intentions and school attainment.

> *I always knew that I didn't want a career in the art sort of thing, so that's how it finally got to the decision. And when I got my grades as well at [age 16] that's how I made up my mind to specifically not pick art or something, but I did enjoy art, so there was always a different… I could choose either one.*

[9] All student names are pseudonyms.
[10] The grading system runs from A to G, with grade A awarded to the highest attaining students.

Her reflections on career intentions show a clear and early commitment to not follow a career in the arts. Her school attainment in these subjects confirmed this decision for her. However, beyond that, she talks of an ongoing uncertainty about what career to follow. In several places during the interview she talks about this uncertainty and her changing ideas about career:

> *Well I wanted to do forensic psychology, and so then it was criminal law because there is sort of a link between that. And I enjoy history and that fits with the law aspect of it, and I think I would find it interesting. And so, I've had trouble knowing what I want to do, so, I keep changing my mind about it.*

Even after making her AS-level course choices she is unclear of her career intentions. Her mixed subject choices at AS-level may be a reflection of this, and a desire to keep her future options open.

Claire describes herself as 'quite a methodical sort of person'. This is reflected in the activities she reports engaging in as she attempts to clarify her career intentions. She has talked to several people about potential careers: a careers advisor in her final year of compulsory schooling, her parents (and particularly her mother) and teachers. At the time of the interview she was arranging a work placement:

> *I've definitely got to research it more, and I think I'm trying to get a work experience placement in a law firm.*

Her approach here reflects that of a 'rational actor'; someone who is attempting to make an informed choice about a future career, and then basing her school course choices around this. In Claire's reflections we do not see serendipitous events impacting strongly at a particular point in time on her choice trajectory (Ball et al., 2000; Foskett & Hemsley-Brown, 2001). Claire is someone who is likely to benefit from detailed guidance about careers in the latter years of compulsory schooling.

School science experiences: the attraction of learning new explanations

Early in her interview, when responding to open questions such as 'How is it that you came to be following these courses?' Claire described what attracted her to specific subjects in school:

> *I think being able to explain like life, and also being able to explain your mind and how it works, or how your heart works or something, and I find that interesting because it's like your body but you don't know about it, and I think it's interesting being able to explain that, being able to explain how different… like the ecosystem, I think that's interesting.*

Here we see a clear intrinsic interest in explaining natural phenomena and human behaviour. She does not refer here to relevance or usefulness of school science subjects.

Elsewhere Claire describes her attraction for subjects with clarity, 'scientificness' and structure:

> *I was looking at forensic psychology before I started the AS-level course, and then psychological ideas is just… I found Freud's ideas, like they're just too based on nothing, I like the scientificness of… it's like there's no scientific study type things really backing them up (…) there's too many different ways to deal with one problem, and like if you did have a patient or something there's so many different theories, and I think I'd just be stressed out as to which therapy you're supposed to treat the patient with or something, so yeah. So I think I've*

switched to… I've not really decided but I want to do law now, because, yeah. And that's got a bit more structure to it.

This perspective on school subjects is consistent with her earlier self-identity as 'a methodical sort of person'. Elsewhere Claire describes how her mother dissuaded her from following psychology because 'it got on her [Claire's] nerves'. Again, this reflects an affective, personal, response to school subjects.

In the final part of the interview Claire is asked specifically about her experiences of science lessons relating science to everyday social or ethical issues. She refers to a range of such experiences including radiation in physics, mobile phones, ethical issues in biology, abortion, ecosystems and food chains. Her immediate reflections on these curriculum elements return to her attraction to explanations:

I find the ones that you can apply to everyday life more interesting than the theory side of it, I think that's why I like physics because you can (…) come away with an explanation of why something happens, and I do find the application of it more like understanding the world. If you come out of the lesson with a better understanding of the world then you feel like you've properly learnt something, as opposed to if it's just some theory that you can't see working really.

She then reflects on what features of a subject attract her to continued study:

I don't know, I think the ones that definitely lead on to something you can see that there's more to learn about it like if you do say the heart, in AS-level they always, like, they haven't told you everything, like with cells in something there's like fifty different things working inside a cell that you didn't know about before, and you can sort of see that it's going to progress on, and I think if you know that there's more to it, or I always find that if I know there's more to it then it makes me interested to carry on with the lesson, to learn more about it

Again, the significance of progression in explanations of phenomena is prevalent here. When pushed to reflect on socio-scientific issues her desire for learning, clarity and explanations means that she is less attracted to a current issue such as climate change:

I think especially with climate change it's kind of a relatively new issue isn't it, and still theories are being thought up, so that's interesting that it's developing. And I think as it develops further the subject of it will probably become more interesting, like as there's more discovered about it and as… But I think in some sort of way the fact that it's happening now and it's such a current topic means that everybody has a basic understanding of it, and so I don't find it as interesting as something that I've never learnt about before..

From these reflections it appears that Claire is a student who is attracted to the explanatory power and clarity of science, as embodied in canonical science knowledge (such as the structure of the heart or the functions within cells). Inclusion of socio-scientific issues in the school science curriculum is unlikely to encourage Claire to pursue post-compulsory science courses.

Anya: "I have always been a maths or science person [since Y10]"

Anya attained an A and a B grade on her two science courses at the end of compulsory schooling. She chose four AS-levels: Biology, Chemistry, Psychology and Sociology. Anya´s trajectory of choice is most closely categorised as 'funnelling identifier' according to Cleaves´s categories, reflecting a career-oriented driver of choice (Table 2). More specifically, in Anya´s case, the trajectory of choice shows strong career-related influence from age 14-15 years.

Anya's course choices are strongly underpinned by her career aspiration. She chose biology and chemistry at AS-level because these courses are needed to become a pharmacist. She identifies this career intention as emerging, and becoming established, in Y9/Y10, i.e. when she was 13-15 years old. Before then, in her early secondary school years, she identified a range of career aspirations including teacher and lawyer.

The aspiration to become a pharmacist has strong family-related ties:

> *Well my uncle's a pharmacist and he owns a few chemist [shops] and I've been in there a few times and recently he's more like training me up, telling me like – so I'm working there regularly, and it's interesting.*

Elsewhere, Anya shows that her career interest went beyond this particular out of school, family-related experience. She describes how, like Claire, she spent time researching different career options, in Anya's case through internet research. She states that she had very little career guidance from staff in her school.

At the end of the interview Anya is asked whether there is anything that she would like to add to the discussion:

> *I want a stable job. Obviously a job with quite good money. Just, you know, that's probably another reason as well. And like pharmacy seemed stable. You can even be full time or you can be like a locum in case a pharmacist is not there, and I could probably work for my uncle if – so there's like a bit of a cushion like in case everything goes wrong.*

These comments reflect the strong career oriented features of Anya's choice trajectory.

School science experiences: enjoying science that relates to me

Anya described her school science experiences in Y7-Y9 as 'quite boring'. However, her science lessons became much more interesting in Y10-11. When asked to elaborate on the differences she reflects:

> *Oh, well in [Y7-Y9] it was just – I can't really explain it – there was like no pushing you and it wasn't so focussed and it was a bit more like experimenting (…) but obviously [in Y10-Y11] they know they've got to make sure we know the stuff otherwise we're not going to pass (…) and getting more help was essential.*

Here Anya is not referring explicitly to a shift in curriculum content from Y9 to Y10. Rather the focus is on the pressure she perceives from teachers to work hard and progress in Y10-Y11.

In the latter part of the interview Anya states that she has 'always been either a maths or science kind of person'. However, when asked to elaborate, she qualifies this, saying that this only applies to her from Y9/10, consistent with her reflections earlier in the interview (as described above).

Anya reflected, unprompted, on her experiences of different science subjects:

> *Physics I just do not like. I just feel like it's the most boring science subject. The reason I like more chemistry is because from the start I've always liked maths, and from young I had tuition in maths, and biology is like quite interesting – I like stuff with the body, stuff like that. Physics, like gravity and all that – I just – doesn't relate with me at all.*

She goes on to give an example of a science topic she has enjoyed:

> *Well, first of all we learnt about different organelles in the body, and now when we talk about – we're doing like health and disease – and like it talks about mitochondria and cilia and that's what we've – so we're putting the before knowledge there now and it just combines nicely like – I know what that is, because I've already been put through it.*

It appears that linking the facts of science (organelles, mitochondria) to everyday issues (health and disease) makes Anya feel that the subject relates to her. She doesn't identify these links in her experience of school physics.

When prompted, Anya identifies a wide range of topics relating science to every day issues. Again, she is positive about these lessons because they relate to her:

> *We did about genetics, even stuff like cloning, and the mobile phone thing, cancer, yeah. Pollution as well, that's always been in science (…) I think because I could relate to them like everyday things, it was more on my level, so I kind of knew a few things and it was like interesting to know more. I learnt a lot, like a lot more.*

She goes on to describe how she enjoys talking to her mother about such issues at home. When asked, Anya says that these lessons did encourage her to choose science at AS-level, because she enjoyed them, but also because she found them 'easy'.

Anya's choice of sciences at AS-level appears to be underpinned by two issues: her enjoyment of science within Y10-Y11, and her desire to become a pharmacist. Both of these align with a choice to follow sciences at AS-level.

School, curriculum and choice across the interview sample

Here we consider how the themes identified in the two case studies are reflected in discussions with the whole interview sample of 22 students.

Influence of teachers and careers advisers

The role of science teachers and school-based careers advisers featured in the interviews with all the students and, in almost all cases they appeared to have influenced the students' choices. The style and activities of the teacher are mentioned by several students as a determining factor for their decision to pursue or not pursue science courses. This reinforces findings from previous studies, and

highlights the importance of teacher professional development for improving science uptake in post-compulsory education. Furthermore, the interviews show that science teachers and careers advisers provide vital information to students on the relation between science courses and professional careers.

Curriculum elements

One of our main objectives was to explore the influence of socio-scientific issues on students' experiences of school science and future course choices. Most of the students in our interview sample reported enjoying debates about socio-scientific issues. However, less than half of the students (9/22) stated that these debates had influenced their choice of science subjects in post-compulsory education. Furthermore, only four of these nine students actually chose post-compulsory science courses. This suggests that whilst many students are attracted to socio-scientific debates, this will not necessarily translate into choosing post-compulsory science courses. Our interview sample also included students who reacted more negatively towards teaching/learning about socio-scientific issues. These students were interested in science, obtained good grades, and chose post-compulsory science courses, but did not value the inclusion of socio-scientific issues in the curriculum. This was mostly because they did not see socio-scientific issues as being "real" science. Overall, we do not identify a direct connection between a positive perception of socio-scientific issues by the students and a choice of science subjects and science-related career.

Strategic and contingent choices

Analysis of our interviews identifies two kinds of choice, distinguished in terms of time-frame and influencing factors. On the one hand there were *strategic* (long-term) choices based on post-school plans. However, we also identify *contingent* (short-term) choices based on the immediate past and future within the school, and influenced by factors often unrelated to future career choices. In both cases student attainment plays an important role, both because schools often use grades to guide students towards, or away from, science courses, and also because students take their grades into consideration when judging their chances of obtaining good results in future courses. Our interviews show that most students make both contingent *and* strategic choices, heavily influenced by school experiences, as illustrated by the following student statement:

> *So all I wanted to do is to keep my options open. So I wanted to have one science at least, maths because it is maths, everyone likes maths, from an employer's point of view. (…) and English literature because I love to read and I found the discussions in our year 12 have been really easy to be quite honest. Like coursework for English literature was the easiest thing to do throughout year 11 and I still don't know how I got an A* in it.*

We can see in this quote that the choice of mathematics is strategic, based on the future value of the subject when applying to university and employment. However, the choice of English is contingent, based on the student's experience of studying English. The interplay of these strategic and contingent choices is a further characteristic of choice *as a process* that unfolds over time.

Conclusions

One aim of this study was to examine the extent to which an emphasis on teaching about socio-scientific issues and the nature of science had encouraged students to choose science courses within post-compulsory schooling. Millar (2010) reports that a science course providing a strong emphasis on teaching about socio-scientific issues and the nature of science resulted in increased uptake of science courses within post-compulsory schooling. In our study responses to the questionnaire do indeed suggest that for many students, both science and non-science choosers, teaching about such issues within compulsory science schooling had encouraged them to consider choosing post-compulsory science courses. However, analysis of student interviews suggests that such teaching impacts *differentially* on students. For Claire (a female science chooser) teaching about social and ethical issues did *not* appear to provide encouragement to pursue post-compulsory science courses. Claire was more influenced by her interest in learning scientific explanations. She was more driven by an *intrinsic* interest in the subject, rather than a need to make the science 'relevant' to her everyday life outside of school (Roberts, 1988). By contrast, for Anya (another female science chooser), relating science to everyday life did appear to provide encouragement to pursue post-compulsory science courses. However, the impact of this feature of the taught curriculum on Anya's choice of science subjects at post-compulsory level did not appear decisive. Rather, she was most strongly guided by her career aspirations. Her attraction to linking science to everyday life aligned with her strong career aspirations, and hence features in her narrative account of the process of her subject choice.

A further aim of this study was to examine the processes through which students come to be following specific courses within post-compulsory schooling. Our use of Cleaves's categories of choice trajectory supports earlier work showing that students exhibit a broad range of trajectories (Cleaves, 2005). For a minority of students in our sample, this trajectory is one of early commitment to a science route through schooling. However, for many students their choice trajectory is characterized by uncertainty and indecision, and includes both strategic and contingent choices. Claire's case study shows a student who has always liked school science, but has been uncertain about whether or not to choose post-compulsory science courses throughout much of her compulsory schooling. We have found it helpful to draw a distinction between an early and ongoing enjoyment of school science ('I've always liked school science') and an early commitment to pursuing a science route through post-compulsory schooling ('I was always going to choose sciences in the future'). Our analysis of a larger number of our case studies has identified many students who enjoy several school subjects (including sciences), and for whom the process of choice is ongoing through compulsory schooling. Thus, our analysis challenges the claim that the majority of students who pursue science courses within post-compulsory schooling develop this commitment early in their school experience (Maltese & Tai, 2010).

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