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Abstract

This paper presents a summary of recent research into patterns of participation in undergraduate science programmes in the United Kingdom. Using data on applications and acceptances through the UCAS scheme, the paper describes trends in the characteristics of those who choose to study science and science-related degree and HND programmes. The findings suggest that overall, recruitment to the sciences remains strong with declining admissions in some areas balanced by growth in others. However, despite recent policy strategies aimed at increasing recruitment to the sciences, the characteristics of students who study 'traditional' science subjects have changed little in the last twenty years. For example, despite some small growth in the proportion of candidates who are female, students who study the Physical Sciences remain largely traditional aged, home domiciled, highly qualified, white, middle class men.

Introduction

More science is now being taught to more students at school than at any time in history (Jenkins and Donnelly 2006, p8). However, falling A-level entries in Physics, Chemistry and Mathematics as well as the recent closure of several university science and mathematics departments, along with criticisms of poor career opportunities and educational experiences and narrow skills development, all point to a crisis in education and training in the sciences (Times Higher Education Supplement 2006, Roberts 2002). What has become known as ‘the science problem’ both threatens the place of the UK as a knowledge-based economy and foreshadows an impending crisis in the provision of scientifically educated workers and scientifically literate citizens (NERF 2005). A lot of the focus of ‘the science problem’ has been on long-standing concerns about how science is taught in schools and in particular on the structure of the science curriculum (NERF 2005, Jenkins and Donnelly 2006, QCA 2005). Much less attention has been devoted to the undergraduate student experience and the trajectory that learners take which lead to careers as professional scientists and technicians (for example Institute of Physics 2007). Making science a core element of the National Curriculum in England and Wales provided the greatest impetus for change in how science was being taught and to whom.
But the impact of ‘science for all’ on patterns of recruitment to undergraduate science and science-related courses over the long term is less clear. Drawing upon existing data retrieved from the Universities Central Admissions Service (UCAS) this paper considers patterns in applications and acceptances to UK Higher Education programmes in order to examine who is studying Science?

In the early 1980s the ‘problem’ of ‘girls and science’ received widespread attention and led to initiatives such as the Girls into Science and Technology (GIST) (Smail et al 1982) and the Women into Science Engineering (WISE) campaigns (WISE 2006). Both of which had the broad aim of increasing the numbers of women who follow careers in science, engineering and technology (SET). These and other similar programmes were based on the premise that girls were not participating in science and that their subsequent lack of qualifications in this area would preclude them from most technical jobs, as well as leaving many women ‘technologically illiterate and at a distinct disadvantage in modern society’ (Smail et al 1982, p.620). In the 1990s, the focus shifted away from the achievement of girls in science, towards that of boys and the discourse of failure and underachievement that was said to characterise the achievement of many boys in most school subjects. One area of concern was boys’ achievement in maths and science where their once clear lead over girls in the examination stakes had now been reduced or had disappeared completely (Arnot et al 1996). More recently, it is the widening participation agenda that concerns many commentators, and in particular the participation and achievement of students from different social and cultural backgrounds, not only in the sciences, but in education more widely (DfES 2003). Given the competing demands on science educators to both raise academic standards and ensure that able young people are not lost to the Sciences, a longitudinal analysis of how patterns of participation have changed over the last two decades is of contemporary interest.

Methods

This paper summarises the patterns of participation in Higher National Diploma (HND) and Degree level courses that were administered through the Universities Central Admission Service (UCAS) scheme. Since 1993 candidates wishing to apply to study at a British University have had to make their application through the UCAS. Prior to this date, applications to universities and the former polytechnics were made through the Universities Central Council on Admissions (UCCA) and the Polytechnics Central Admissions Service (PCAS). Both organisations merged in 1993 to form UCAS. 1986 was chosen as the starting point because it is the first year in which applications to Higher Education were administered through both the UCCA and the PCAS schemes. Prior to 1986 there was no systematic centralised collection of relevant data relating to applications to the former polytechnics and colleges of Higher Education. The data used in this analysis was retrieved from the Statistics pages of the UCAS website. Data prior to 1996, and which is not available electronically, was obtained from the UCAS/PCAS/UCCA annual reports which were retrieved directly from UCAS. This summary is taken from the larger report Smith (2008).
The paper describes variations in the characteristics of learners who applied to and were accepted for Science and Science-related courses between 1986 and 2007. As with all empirical research projects, several adjustments had to be made to the data before analysis could proceed. These are summarised below:

Institutions

The number of institutions participating in the UCAS scheme has increased hugely from the 30 polytechnics and pre-1992 universities who administered their applications through PCAS and UCCA in 1986. The introduction of new degree and HND awarding institutions has resulted in a steady increase in the number of places on offer to prospective candidates. This does have some effect on the comparability of data over time. However, it is not the intention to compare institutions over time, simply to characterise the candidates. Therefore any increase in the number of awarding institutions can be seen in response to a demand for places and reflect the natural growth of the system. Note that candidates who study with the Open University do not apply through the UCAS scheme - these candidates are not included in this analysis.

Subject Groups

Candidates applying through UCAS in 2007 could make their application to one of 25 different Subject Groups. Over the time period considered in this study, a number of changes have taken place to the organisation of Subject Groups and the individual Subjects which make up the Groups. In order to ensure accurate comparisons of both Subject Groups and individual Subjects, both have been reorganised to reflect, as far as possible, the arrangements used in 2007 (see Smith 2008, for a fuller discussion). In this study we were interested in participation in all Science programmes, as well as the individual science Subject groups and separate subjects. We define the Sciences broadly and include subjects such as Architecture and Combined Science Subjects, as well as more 'traditional' Science subjects such as Physics and Medicine. The Science Subject Groups used here are listed below; the labels used in this paper are given in parenthesis.

<table>
<thead>
<tr>
<th>Group</th>
<th>Label</th>
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<tr>
<td>Group A</td>
<td>Medicine and Dentistry (Medical Sciences)</td>
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<tr>
<td>Group B</td>
<td>Subjects allied to Medicine (Allied Medical Sciences)</td>
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<tr>
<td>Group C</td>
<td>Biological Sciences (Biological Sciences)</td>
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<tr>
<td>Group D</td>
<td>Vet Sciences, Agriculture and related (Agricultural Sciences)</td>
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<td>Group F</td>
<td>Physical Sciences (Physical Sciences)</td>
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<td>Group G</td>
<td>Mathematical and Computational Sciences (Mathematical Sciences)</td>
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<td>Group H</td>
<td>Engineering and Group J Technologies (Engineering Sciences)</td>
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<tr>
<td>Group K</td>
<td>Engineering and Group J Technologies (Engineering Sciences)</td>
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<tr>
<td>Group Y</td>
<td>Architecture, Building and Planning (Architectural Sciences)</td>
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<tr>
<td>Group Y</td>
<td>Sciences combined with social sciences or arts (Combined Sciences and other)</td>
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<tr>
<td>Group Y</td>
<td>Combined sciences (Combined Sciences)</td>
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Applications
Between 1988 and 1993 candidates applying through the UCCA scheme were not required to state a preference for their chosen courses, instead they were required to list 4 or 5 potential courses (PCAS has operated this system since 1986). Because an individual was able to make multiple applications this would result in an over-inflation of the applications figures. Therefore, as one individual could make up to 5 different applications, it is important to differentiate between the number of applicants and the number of applications being made. Unfortunately, between 1986 and 1993 data on the number of applicants is not available, necessitating an adjustment to the figures for applications. A fuller discussion about the steps taken to derive these estimates appears in Smith 2008.

Student characteristics

Other issues concerning the categorisation of the different groups of students are considered below:

Social class: since 2002, occupational group data has been categorised using a simplified version of the National Statistics Socioeconomic Classification (NS-SEC) scheme. This makes it difficult to draw comparisons with occupational data collected prior to 2002 which was coded using the Standard Occupational Classification 1990 scheme. Therefore two separate analyses were undertaken: the first considers the period 1994-2001 and the second 2002-2007. Prior to 1994, limited data on occupational group was presented in the UCCA annual reports. Therefore this analysis of social class extends back to 1994 only. This analysis is for home-domiciled candidates only. The assignment of socio-economic status is based on an applicant's parental occupation (or the occupation of the person contributing the highest income to the household if the applicant is aged 21 years or over). Social class data is only available at the Subject Group level; no analysis was possible for separate subjects.

Ethnic origin: since 2002, 15 categories of ethnic origin have been used by UCAS; prior to 2002 there were 10. However, minor adjustment to the ethnic categories has enabled us to undertake a continuous analysis back to 1994. This adjustment involved collapsing 'mixed' ethnic groups into the 'other' category. As with the occupational data, UCCA collected limited data on ethnic groups, therefore this analysis commences in 1994. This analysis is for home candidates only. Ethnic group data is only available at the Subject Group level; no analysis was possible for separate subjects.

Age: in order to compare the age of candidates applying to and entering Higher Education, two age categories were adopted: those aged 21 and under (here termed 'traditional' age candidates) and those aged 22 and over (here termed 'non-traditional' age). Data collected by UCCA and PCAS on the age of candidates is very detailed and allows us to extend our analysis in detail from 1994 and in snapshot back to 1986. This analysis is for home candidates only.
Qualifications: in 2002, UCAS moved to a tariff system for recording candidate's qualifications. This enables a comparison of the large range of qualifications upon which candidates base their applications. In this report two phases of qualification are considered: prior to 2002 and which is based only on candidates with A-level qualifications and 2002 onwards, which considers all qualifications. This analysis is for home candidates only.

Domicile: for comparison candidates whose domicile was EU or outside the EU were categorised as 'overseas' students, those whose domicile was the UK were categories as 'home'.

Findings

This section summarises the findings of the study, it is intended to provide the reader with a snapshot of recruitment patterns since the mid-1980s. It begins by considering patterns of participation for All Subjects followed by All Science subjects, the discussion then moves on to look at patterns for the largest Science Subject Groups and selected separate subjects.

All Subjects

Since 1988, the number of candidates who apply through UCAS (and the former UCCA/PCAS scheme) has doubled to over ½ million. In 2007, 454,148 candidates who were domiciled in the UK applied for places. In the same year, 364,544 home candidates were offered places by UK Universities. The acceptance rate for candidates has changed quite significantly over this time. In the late 1980s, there were around twice as many applicants for each place with 44% of applicants not placed, today 20% of applicants are not accepted to study through UCAS. The number of female candidates who both apply and are accepted to study has increased steadily, so that by the mid-1990s, more female than male candidates were entering Higher Education. Sex stereotyped patterns persist in many subjects: female candidates dominate in the Biological Sciences and in Languages, male candidates in the Mathematical and Engineering Sciences.

There has also been a large increase in the number of candidates from overseas. In 1988 10,593 students accepted places; in 2007, the figure was almost 50,000. Since the mid-1990s around 15% of all applicants have come from abroad. As with home candidates, the acceptance rate for overseas candidates has also fallen during the period considered: from almost three applicants for every place in 1988 to 1.6 in 2007. In terms of A-level and other qualifications upon entry, candidates are now much better qualified than their predecessors. For those applying after 2002, well over half have at least Grades BBB at A-level or equivalent and the trend towards higher qualifications continues. Despite the current climate of widening participation in Higher Education, around 20% of candidates who apply are aged 22 or over; among accepted candidates, the figure is around 16%: figures which have hardly changed since the early 1990s. Since 1996 around half of all applicants and accepted candidates are from the Professional or Intermediate
occupational groups, a figure which has varied little over time. Around three quarters of candidates are White, another figure which has shown little variation, although there is no evidence to suggest that candidates from ethnic minority groups (as a whole) are under-represented in Higher Education.

**All Science Subjects**

Since 1988, just under 40% of all home candidates who applied through UCCA/PCAS applied to study the Sciences, a figure which has altered little over the last twenty years. Since 1994 the number of Science applicants has increased by 28% which is slightly higher than the 24% increase seen for all subjects. The proportion of all candidates who are accepted to the Sciences is currently 42%, which is slightly lower than the 49% we saw in 1986. However, the number of candidates accepted to study the Sciences has risen from 55,117 students in 1986 to 153,441 in 2007. One third of all female candidates apply to and are accepted to study a Science subject. Currently the Sciences account for around 40% of all male applications and half of all the places that are accepted by men. Suggesting that overall the Sciences continue to attract a larger share of male applications and acceptances than they do female. Within the Sciences, in 2007 50% of all applicants were female (in 1988, the proportion was around a third) and similarly 47% of all candidates who accepted were women (again this is an increase from 31% in 1986). Although more female candidates apply and are accepted to study in Higher Education, it is clear that they are now more likely to be represented in the Sciences than they were two decades ago. Indeed, when considered broadly, the Sciences have arguably become more gender neutral.

Trends in the acceptance rate for male and female candidates to the Sciences have been fairly similar, although recently the ratio of applicants to acceptances has been lower for male candidates (around 1.00) than for female (around 1.15). In 2007, 81,626 male candidates applied of whom 81,626 accepted places (164 not offered places). For female candidates there were a similar number of applicants (82,141) while comparatively fewer (71,979) were offered places. This suggests that male candidates are more likely to be offered places in the Sciences overall than female candidates.

Around 36% of all applicants from overseas apply to study the Sciences, this share has fallen since 1994 when applications to the Sciences were made by almost half of all overseas candidates. Within the Sciences, around 15% of all applicants come from abroad, a figure that has varied little since the mid-1990s; slightly lower figures are found for accepted candidates but the trends are similar. Currently 44% of all places that are accepted by overseas candidates are in the Sciences.

Science students are at least as well qualified as all students taken together and they also have a similar age profile: in 2007 almost 60% of accepted candidates had at least BBB or equivalent at A-level, this has risen from 48% of candidates in 2002. Female Science candidates have the highest grades of all students - Science and otherwise. With regard to age, the age profile of Science students has changed little since the mid-1990s: around 17% of candidates accepted to study the Sciences are aged 22 and over.
The Medical Sciences

Main subjects: Medicine and Dentistry

Around 4% of all applicants though UCAS apply for a place in the Medical Sciences, currently over 7000 candidates are accepted to study Medicine, this is almost double the number who were accepted in 1986. Around 56% of candidates who are accepted to the Medical Sciences are female; this has increased steadily since 1986 when the figure was 46%. Candidates for the Medical Sciences are the most highly qualified of all UCAS Subject Groups. Around 20% of applicants come from overseas, a figure that is slightly higher than the average for all Subjects. In 2007 a quarter of applicants to the Medical Sciences were of non-traditional age, this figure has increased from 12% of all applicants in 1996. Medical Science students are overwhelmingly recruited from the Professional and Intermediate occupational groups. In 2007 almost 70% of accepted candidates came from these groups, compared with 50% for all UCAS candidates. Around 11% of students accepted to the Medical Sciences are of Indian origin, in comparison 4% of all applicants are Indian.

The Allied Medical Sciences

Main subjects: Pharmacy and Nursing

The Allied Medical Sciences have seen the number of applicants increase from around 9,000 in the late 1980s to over 37,000 in 2007; this increase is largely due to changes in admissions procedures for Nursing courses. The share of all UCAS applicants who apply to the Allied Medical Sciences has increased over the period and is now around 8%. Acceptance figures have also seen a similar increase: from 2% of all UCAS acceptances in 1986 to 7% in 2007. Currently 80% of all applicants to the Allied Medical Sciences are female and the share of applicants who apply to this Group is now 12% of all female applicants, making this one of the largest Subject Groups in the UCAS scheme. It is also a selective Subject Group in that it receives more applicants than it accepts. Around 5% of overseas applicants apply to the Allied Medical Sciences and a third of candidates who are accepted to this Subject Group are of non-traditional age, this is compared with around 17% of candidates for the Sciences overall.

Nursing

The number of home candidates applying for courses in Nursing has increased from around 1000 in the late 1980s, to over 15,000 in 2007, largely as a result of changing admissions procedures. In 2007, 7,525 were accepted to study Nursing. Candidates wishing to study Nursing are overwhelmingly female (92% of accepted candidates in 2007 were women). Only a small proportion came from overseas, around 40% are of non-traditional age while around a similar proportion were admitted with at least A-level BBB or equivalent, although this figure is increasing.
The Biological Sciences

Main subjects: Biology, Psychology and Sports Science

Over 30,000 students currently apply to study the Biological Sciences - this is around 7% of all UCAS home applicants. The number of applicants has increased by over 10,000 since 1994 although the share of applicants remains the same. In 1986, 7,523 candidates accepted places on Biological Science programmes. Today the figure is over 30,000. This increase is largely due to the popularity of Psychology and Sports Science courses, which are considered separately in the next section. In common with many other Subject Groups, the acceptance rate for the Biological Sciences has fallen: in 2007, just fewer than 2,000 applicants were not offered places, in 1994, the figure was over 5,000. Around 60% of candidates accepting places in the Biological Sciences are female; this figure is little changed since 1986 when it was 55%. There are similar patterns in the applicant data. Around 7% of all candidates accepted to the Biological Sciences come from overseas. Traditionally, candidates who wish to study the Biological Sciences are among the highest qualified of all UCAS candidates. In 2007, 57% of accepted candidates achieved at least A-level BBB or equivalent, a figure that was in line with the average for all subjects. However in 2001, the proportion achieving the highest grades for this Subject Group was above the UCAS average, suggesting that there has been a fall in the proportion of highly qualified candidates accepted to this Group, one possible reason for this is the impact of increased recruitment to Sports Science programmes (see below). Currently, around half of all Biological Sciences programmes are taught in pre-1992 institutions, this is in line with the UCAS average but has decreased from two-thirds of Biological Science programmes being taught in these universities in 1996. Candidates studying the Biological Sciences are more likely to be traditional age, around half come from the Professional and Intermediate occupational groups (similar to the average for all Subjects) and over 80% are White.

Biology

In 1994, 6114 candidates applied to study Biology. By 2007, this figure had fallen to 3761. Over the same time period the number of accepted candidates had fallen from 5373 to 4053. Currently 58% of candidates accepted to study Biology are female, a figure which has increased from 51% in 1986 showing a slight tendency towards an increased feminisation of the subject. Just as with Chemistry, Biology is also a recruiting rather than a completely selective subject (in that it accepts more students than originally apply). Even so, it is also a subject which attracts a high proportion of well qualified candidates: in 2007 almost 70% of accepted candidates had achieved at least BBB or equivalent. Female biologists were particularly well-qualified, with almost three quarters achieving the highest grades in 2007. As with Chemistry and Physics, only a relatively small proportion of Biology students come from overseas: in 2007 10% of accepted candidates came from abroad. Around 10% of Biology students are aged 22 and over, a figure that has remained stable since 1994.

Psychology
Prior to 2002, Psychology was administered under both Biological Sciences and Social Studies and Law Subject Groups. In this analysis, where possible, it is combined under the Biological Sciences. In 1988, almost 7,000 home candidates applied to study Psychology; this had doubled by 2007. In 1986, just over 2,000 candidates were accepted to study Psychology - the figure today is almost 13,000. Psychology is particularly popular among female candidates: currently over 80% of accepted candidates are female, a figure that has risen from 72% in 1986. There has been little variation in the proportion of overseas candidates who wish to study Psychology: in 2007, 9% of applicants and 7% of accepted candidates came from overseas. In 2007, 15% of accepted candidates were aged 22 and over. The prior qualifications of Psychology students is similar to those who study Biology with just under two thirds achieving at least BBB or equivalent.

Sports Science

Sports Science has become an increasingly popular subject. It was not listed as a separate subject prior to 1996 and so we cannot monitor trends before this date. Since 1998 when recruitment to this subject began to take-off, the number of applicants has increased from 7,043 to 10,766 and the number of accepted candidates from 4,485 to 9,619. Sports Science is more popular among male candidates: around two thirds of applicants and acceptances are men. It attracts very small proportions of overseas students and typically around 30% of candidates have at least grades BBB or equivalent. In 2007, 37% of female Sports Science acceptances achieved the highest grades, compared with 27% of men.

The Physical Sciences

Main subjects: Physics, Chemistry and Physical Geography

Since 1988, the number of home candidates applying to study the Physical Sciences has increased from around 12,000 to just over 14,000 in 2007. This is lower than the rate of increase for all Science and Science-related subjects. Since 1994 when entries to HE were administered under the joint UCAS scheme, the number of Physical Science applicants has fallen by 10%, from 15,841. The Physical Sciences currently attract around a 3% share of all UCAS home applicants, this has varied only slightly since 1988.

The number of home candidates accepted to places within the Physical Sciences has increased from 8,410 candidates in 1986 to 14,583 in 2007, it retains around a 4% share of all UCAS places. As with some other Science Subject Groups, the Physical Sciences have become a recruiting rather than a selecting subject: since 1996 more candidates have been offered places on Physical Science programmes, than originally applied. Similarly since 1994 the rate of growth of accepted candidates has been larger than that of applicants (a pattern we see repeated among many of the other UCAS Subject Groups - science and non-science). For example, currently over 400 more candidates are offered places than originally applied, these extra candidates were overwhelmingly female.
The Physical Sciences continue to attract more male home candidates. Around 4% of all applications from male candidates are to the Physical Sciences, for women the figure is around 2%. These patterns have been well established since 1988. Within the Physical Sciences, the proportion of applicants who are female has increased steadily: from 29% in 1988 to 38% in 2007. Further evidence of the tendency of the Physical Sciences to become more gender neutral can be seen with acceptance data: in 1986, 2,192 female candidates accepted places in the Physical Sciences; today the figure is over 5,800. Among men, we see an increase from 6,218 acceptances in 1986 to 8,717 today. In addition, currently 40% of all candidates who accept places on Physical Science programmes are female, in 1986, the proportion was around a quarter.

The number of candidates who apply to the Physical Sciences from overseas has increased only slightly since the mid-1990s. Only around 2% of all overseas candidates are accepted to the Physical Sciences, in comparison, 15% of all overseas candidates are accepted to study the Engineering Sciences. Within the Physical Sciences around 9% of applicants and 8% of accepted candidates come from overseas: a trend which has been established since the mid-1990s.

Despite being a recruiting rather than a selecting Subject Group, there is no evidence to suggest that candidates who apply to or study the Physical Sciences are any less well-qualified than their peers in other Science and non-Science programmes. Indeed, while the trend is towards all candidates achieving higher entry qualifications than their predecessors, in the Physical Sciences nearly 70% of applicants and accepted candidates have grades that are equivalent to or higher than BBB at A-level (only candidates to the Medical Sciences have higher grades). By way of comparison, for All Subjects taken together, in 2007 54% of applicants and 57% of accepted candidates had these grades (the figures for All Science subjects is a few percentage points higher). Female Physical Science candidates are just as well qualified as their male peers.

Currently around 80% of all candidates applying to study the Physical Sciences apply to pre-1992 universities and around a similar proportion of those who accept places will study in these institutions. Around 5% of candidates who accept places to study in pre-1992 universities will study the Physical Sciences. Among All Subject Groups around 20% of applicants are aged 22 and over. In the Physical Sciences, non-traditional aged students account for 7% of all applicants and 9% of all accepted candidates. These are patterns which have been established since the early 1990s. There is no suggestion in this data that initiatives to widen the participation of non-traditional aged candidates have had any impact on applications and acceptances to the Physical Sciences (or to the Biological Sciences as we saw above).

Currently around half of all home candidates who apply through UCAS are classified as belonging to the Professional and Intermediate occupational groups, for the Physical Sciences, the figure is around 60%. Similarly for accepted candidates 59% come from Professional or Intermediate backgrounds, compared with 50% for candidates overall. These patterns have been well-established since the mid-1990s, any variation that we do see in figures has largely arisen because of candidate non-response. Around three
quarters of all accepted candidates list their ethnic origin as White. At 86%, the Physical Sciences have the highest proportion of White candidates among the main Science Subject Groups.

Separate Physical Science subjects

Physics
The number of Physics applicants has changed only slightly since 1994. In 1986, 2479 candidates were accepted to study Physics, in 2007 the figure was 2905. In the interim, the figure has varied only by a few hundred students. Just under 20% of Physics applicants and acceptances are female, a figure which has been stable since the late 1980s. There has been a slight increase in the proportion of Physics candidates who are domiciled overseas: from 8% of all Physics applicants in 1996 to 12% in 2007 (figures for acceptances are similar). Physics candidates are amongst the most highly qualified: in 2007, 85% of accepted candidates had at least BBB at A-level or equivalent. Female candidates are slightly better qualified than their male peers: 88% of female candidates achieved at least BBB or equivalent compared with 84% of men. Finally, Physics candidates are largely of traditional age (only around 5% of accepted candidates are aged 22 and over). In short, the profile (and number) of candidates studying Physics has changed little over the last two decades.

Chemistry
Applicants to Chemistry courses have fallen since the mid-1990s, although numbers are currently on the increase. In 2007, there were 3,166 applicants with 3,530 candidates being offered places, 250 of the extra candidates were women. Since 1986, the number of candidates offered places on Chemistry courses has increased by 667. There has been a steady increase in the proportion of women candidates: currently 41% of candidates accepting places on Chemistry courses are female. Despite being a recruiting rather than a completely selective subject, Chemistry students are also among the most highly qualified of all UCAS candidates: almost three quarters of applicants and accepted candidates achieve at least BBB or equivalent. They are however less likely to be of non-traditional age and come from overseas: in 2007 only 10% of accepted candidates came from overseas and 6% were aged over 22.

The Mathematical Sciences

Main subjects: Mathematics and Computer Science

The Mathematical Sciences have seen a 15% increase in the number of applicants since 1994. Currently 20,967 candidates apply for places, although this is lower than the high of 35,324 candidates we saw in 2001. In 2007, the Mathematical Sciences recruited 320 more students than originally applied, half of who were female. The Mathematical Sciences are more popular among male students, currently 10% of all UCAS places accepted by men are in the Mathematical Sciences, and around 80% of candidates who are offered places on Mathematical Science courses are men. Around 7% of all overseas candidates are accepted to study the Mathematical Sciences. A slightly lower proportion
of home candidates who apply to and/or are accepted to study the Mathematical Sciences have the highest prior qualifications, compared with students overall. In 2007, 51% of accepted Mathematical Science candidates had at least BBB or equivalent, compared with 57% for all UCAS subjects (the figures for applicants are 48% and 54% respectively). The likely reason for this is because of the relatively low grades of many candidates who study Computer Science. Mathematical Science students tend to have a similar age profile to all students: around 15% are of non-traditional age, a pattern which is little changed over the last decade or so. A smaller than average proportion of candidates accepted to study Mathematical Sciences come from the Professional or Intermediate occupational groups, in 2007 this was 45%, compared with 59% for the Physical Sciences. Around two thirds of students accepted to study the Mathematical Sciences come from a White background, this compares with 86% of Physical Science candidates. The Mathematical Sciences appear to attract a more diverse group of students than the Physical or Biological Sciences. Although largely male, Mathematical Science students tend to be slightly older, and are less likely to be white and middle class, although they also tend to be less well qualified then their peers in the Physical and Biological Sciences.

Mathematics
The number of candidates accepted to study Mathematics has roughly doubled since 1986 to 5,014 in 2007. The number of applicants has also increased steadily, although in several years slightly more mathematicians have been accepted than originally applied. Around 40% of applicants and accepted candidates are female, a figure which has increased slowly since the late 1980s. The proportion of overseas candidates has increased since 1996: from 6% of all acceptances to 15% in 2007. Students who study Mathematics tend to have the highest prior qualifications: since 2002 over 80% of accepted candidates have had at least BBB or equivalent. Female mathematicians are slightly better qualified than their male peers.

The Engineering Sciences
The share of UCAS home applicants to the Engineering Sciences has fallen since the late 1980s and currently accounts for 3% of all applicants. Similarly the number of candidates applying to study the Engineering Sciences has fallen by 30% since 1994 to around 16,250 candidates today. However, the number of candidates accepting places has increased, from 14,422 in 1986 to 17,652 in 2007, although the share of candidates who study this subject area has declined. The Engineering Sciences remain popular among male students, consistently only around 13% of candidates accepted to the Subject Group are female. As with the Physical Sciences, the Engineering Sciences is a recruiting rather than a selecting Subject Group. In 2007, places were offered to almost 1,500 more students than originally applied (almost half of whom were women). The Engineering Sciences recruit a large proportion of candidates from overseas. Around 10% of all overseas applicants apply to the Engineering Sciences and almost a third of students accepted to study the Engineering Sciences come from abroad. Engineering Science home students tend to be similarly qualified to Science students overall, around 60% have at least BBB or equivalent. Although female candidates are less likely to study the
Engineering Sciences, those that do can be better qualified than their male peers. For example, in 2007, 81% of female candidates accepted to study Civil Engineering had the highest grades, compared with 69% of men (although the relatively small number of women students does necessitate some caution in interpreting this finding). Students studying the Engineering Sciences have a similar age profile to all UCAS candidates, a comparable number are from Professional or Intermediate backgrounds and around 70% are White.

**Combined Subjects**

Two UCAS Subject Groups admit students who wish to study combinations of the Sciences, either alone or with other Arts and Social Science Subjects. While enrolment to both Groups has increased since 1996, it is the Sciences Combined with Arts and Social Sciences Subject Group which has seen an increase from almost 8,000 accepted candidates in 1996, to over 17,000 in 2007. This increase means that Sciences combined with Arts and Social Sciences now recruits more students than the Physical Sciences. It is also a subject which attracts similar numbers of male and female candidates. Although candidates who accept places tend to be less well qualified than for the other Science Subject Groups (including the Combined Sciences). In 2007, 46% of candidates had achieved A-level BBB or equivalent. The Combined Sciences recruit around 6,000 applicants a figure which has increased slightly since the mid-1990s.

**Summary**

The following conclusions can be drawn from this data. The recent expansion in Higher Education has been reflected recruitment to the Sciences. Although the number of candidates applying to study the Physical and Engineering Sciences has fallen since the mid-1990s, this has been balanced by increased recruitment in other Science areas. Even so, both the Physical and Engineering Sciences do now recruit many more students than they did in the late 1980s. Sex stereotyped patterns of choice persist within several of the Science Subject Groups, although half of all candidates who now study Science and Science-related subjects are female. The Mathematical and Engineering Sciences still largely recruit male candidates while the Medical, Allied Medical, and to a lesser extent, the Biological Sciences have become more feminised. The Physical Sciences have arguably become more gender neutral and now 40% of all candidates who are accepted to this group are female. In common with many non-science subject groups, many Science Subject groups have become recruiting rather than selecting subjects, in other words they offer places to more candidates than originally applied. Even so, there is no evidence to suggest that Science candidates are any less well qualified than previously, in terms of A-level and equivalent qualifications. Indeed, in 2007 69% of candidates accepted to the Physical Sciences had achieved at least A-level grades BBB or equivalent, for all subjects, the figure was 57%. Additionally, 88% of female physicists and 87% of female mathematicians achieved the highest grades – both figures were slightly higher than those for male candidates.
In terms of other social characteristics, trends have altered only slightly during the period considered. With the exception of the Engineering Sciences, only a relatively small proportion of candidates who study Science come from overseas: around 8% for the Physical Sciences. Science students still tend to be largely of traditional age: only around 7% of Chemistry and Physics students are aged 22 and over. Although around a third of candidates who study the Allied Medical Sciences are of non-traditional age. Patterns in participation according to social class are also relatively stable and what variation does occur can largely be accounted for by non-response. In 2007, 69% and 59% of candidates accepted to the Medical and Physical Sciences respectively were from Professional or Intermediate backgrounds. For all UCAS acceptances, the figure was 50%. With regard to ethnic background, around three quarters of applicants are from white backgrounds a figure which has decreased from 80% in 1996. When compared with data from the Census, this finding does not suggest that people from non-white backgrounds (taken as a whole) are under-represented in the participation data, although some more work is needed to compare national patterns alongside the data for the separate minority groups. The patterns that we see within the ethnic group data have been relatively stable over time. In the Biological and Physical Sciences, 81% and 86% of accepted candidates are white, a figure that is higher than that for white candidates overall. Similarly, slightly higher than average proportions of candidates from minority ethnic groups opt to study the Medical, Allied Medical and Mathematical Sciences.

In the two decades for which participation data is available, we have seen a range of policy initiatives whose aim, either directly or indirectly, has been to recruit more young people into the Sciences. Making Science a core component of the National Curriculum in the late 1980s meant that thousands more young people would continue to study sciences until the age of 16. However, recruitment patterns into Higher Education since the early 1990s do not suggest that this has had a significant impact on the numbers choosing to study the sciences at the highest levels. Similarly the widening participation agenda (DfES 2003) has not resulted in more non-traditional age students studying the Sciences in Higher Education.

One possible explanation for why the relatively recent expansion of Higher Education has made little difference to the numbers of students who study the ‘traditional’ Sciences is that these ‘new’ recruits to Higher Education are those who were never likely to study the Sciences anyway. Students who were likely to study subjects such as Physics or Chemistry, which require relatively high entry grades, were always likely to progress to Higher Education and would have been largely unaffected by the widening participation agenda. One indication that this might be the case is the lack of variation in the characteristics of undergraduates who have chosen to study the Physical Sciences over the last twenty five years or so: they are still largely high achieving, traditional aged, White, middle class men. This argument is similar to that advanced in the ‘swing from science’ debate towards the end of the 1960s and used to account for falling recruitment to the Sciences in the face of an expanding sixth form population. At the time, one reason given for the apparent relative decline in the number of students studying Science post-16 was the increased choice of mixed arts and Science options that were now available to a growing sixth form population, many of whom would additionally have had to have
chosen to specialise in Science at age 13 (Dainton Report 1968, Duckworth and Entwistle 1974). Two groups of students in particular were affected by this increase in the number of students staying on post-16: girls and students of lower ability. Neither group according to Duckworth and Entwistle (1974) were likely to study the Sciences. Similar patterns were seen for foreign languages, leading to the suggestion that subjects which experienced a ‘swing’ were arguably those which required greater aptitude:

‘The sciences have not really ‘lost’ many recruits because of a change in pupils’ attitudes towards science, rather some have been attracted away by the welcome diversification of sixth form courses while others, ‘new’ sixth formers, have never been serious candidates for science (or languages) courses because they find these subjects particularly difficult’ (page 53).

This is not to say that the picture is entirely pessimistic, although the characteristics of students studying many of the sciences has changed little in the last twenty years, it is still the case that over half of all candidates studying at British Universities are studying a broadly scientific subject. However, whether they are studying the 'right' Science remains a moot point.

References


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