Gravitating towards physics

How will higher fees affect the choices of prospective physics students?

A report prepared for the Institute of Physics by YouthSight

IOP Institute of Physics
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Cover image:
The motion of a planet’s orbit around a star, simulated by rolling a ball on a curved surface of plastic. The purple ball represents a star and is resting on a sheet of plastic that stretches under its weight. The curved sheet of plastic demonstrates the way gravity curves space.
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BACKGROUND AND INTRODUCTION

Background and research objectives

Recent government changes to UK higher-education funding mean that many English universities will charge tuition fees of nearly £9000 from the academic year 2012/13. In light of this, the Institute of Physics (IOP) decided that it was important to examine the potential impact of higher fees on young people’s decision to study physics at university.

In commissioning this study, IOP had several aims:

• To equip the higher-education sector better, to face upcoming challenges in attracting students in an era of high student fees and debt, by exploring how physics should position itself in an increasingly competitive market
• To identify strategies that can help the sector respond more effectively to negative perceptions and low levels of knowledge about physics, thereby widening the appeal of the subject
• To help higher-education institutions align marketing efforts more closely with the aspirations of university applicants while maintaining the high standards associated with physics degrees.

To meet these aims, IOP formulated the following overall research objectives:

• To determine the decision-making process of prospective physics undergraduates, and to understand why some who are eligible choose not to study the subject
• To assess the potential impact of imposing £9000 fees on prospective physics undergraduates
• To investigate prospective applicants’ knowledge and perceptions of physics generally, and career paths in physics specifically
• To understand whether these factors vary for physics applicants from different backgrounds.
Methodology
To address the aims and objectives outlined above, IOP commissioned a three-phase study from YouthSight, a research agency and access panel specialising in young people, students and young professionals.

Phase 1 was a subject-level analysis of data from YouthSight’s 2009/10 and 2010/11 Higher Expectations studies, derived from a survey of 22,226 full-time undergraduates in their first year of study at UK higher-education institutions.

Phase 2 involved five focus groups: two with prospective physics students, one with current university students who considered physics but chose a different subject, and two with graduates who hold physics degrees. This phase explored young people’s reasons for choosing to study physics, how they perceive the subject in terms of reputation and employability, their knowledge of physics careers, and their views on higher fees and levels of debt.

Phase 3 was a survey of 530 university applicants who had either applied to study physics at university or who had considered doing so but applied to study a different subject instead. This phase aimed to quantify young people’s reasons for either choosing or not choosing to study physics at degree level, their perceptions of physics, their awareness of careers and careers information, and their attitudes towards tuition fees and student debt. A further aim in this phase was to understand whether findings varied by gender, age, ethnicity, social grade and likelihood of entering higher education. It should be noted that, although tuition fees will increase in England, the study was conducted with applicants, students and graduates from across the UK in order to obtain robust sample sizes.

A full description of the methodology, including fieldwork dates, can be found in the Appendix.

1 Of the 530 respondents to the Phase 3 survey, 73% were from England.
About this report
This report draws together findings, conclusions and recommendations emerging from all three phases of the study. It presents them as a narrative that runs from young people’s initial interest in physics through to their perceptions of careers in physics, examining along the way their choices and perceptions during the university application process. The report is structured into six sections:

1. The initial attraction to physics
2. Choosing to study physics at university
3. Choosing not to study physics at university
4. Perceptions of subject reputation
5. The potential impact of higher fees and debt levels

There are, however, two recurring threads in the narrative: the need to tackle issues of diversity and the need to raise awareness of potential careers from physics. These threads are brought together in the executive summary.

Definitions
The study involved research with physics “accepters” and “rejecters”. **Accepters** are young people who applied to study physics at university (Phases 2 and 3 of the research), are currently studying physics (Phase 1), or who graduated with a physics degree (Phase 2). **Rejecters** are young people who strongly considered studying physics at university but applied to a different subject (Phase 3) or are currently studying a different subject at university (Phase 2).
Because physics students are more likely than average to be young white men from ABC1 backgrounds who have university-educated parents\(^2\), Phase 3 of this study sought to understand whether findings vary by demographic and sociographic factors. In this report, we therefore refer to students with a “**traditional** physics student” profile (i.e. male, white, higher social grade, more likely to have parents with higher-education experience) and those who fit a “**non-traditional** physics student” profile (female, ethnic minority, lower social grade, less likely to have parents with higher-education experience).

Similarly, applicants from **higher social grades** are those falling into the AB categories, while those from **lower social grades** fall into C1C2DE\(^3\).

Data from the Phase 3 survey were analysed by the **Widening Participation POLAR quintile**. The POLAR (Participation of Local Areas) is a classification of small areas across the UK, available from the Higher Education Funding Council for England (HEFCE) as a series of maps and datasets, illustrating how the chances of young people entering higher education vary by where they live. Respondents in the lowest quintile are least likely to enter higher education, and those in the next quintile are the next least likely; we have grouped the upper three quintiles together as these respondents are more likely to enter higher education.

**Significant differences in tables and charts**
In this report, statistically significant differences in data shown in tables are denoted by cell colour, as described in the table footnotes. A comparison is generally made only between physics and both the UK average and competitor subjects. Differences between competitor groupings are not highlighted.

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\(^2\) Based both on Higher Education Statistics Agency (HESA) data and demographic analysis of the Phase 1 data, \(n = 22,226\).

\(^3\) We use the National Readership Survey’s social grade classification system, which is based on the occupation of the chief income earner in a household. In the context of surveys with university applicants and students, this is usually the highest-earning individual in the parental/guardian household. For more information see www.nrs.co.uk/lifestyle.html.
EXECUTIVE SUMMARY

Introduction
Recent government changes to UK higher-education funding mean that many English universities will charge tuition fees of nearly £9000 from the start of the academic year 2012/13. The Institute of Physics (IOP) therefore decided that it was important to examine the potential impact of these higher fees on young people’s decision to study physics at university, and commissioned YouthSight (a research agency and access panel specialising in young people, students and young professionals) to conduct a broad three-phase study into the issues.

This consisted of secondary analysis of data from a large survey of first-year undergraduates\(^4\), focus groups with university applicants, students and graduates who considered or chose physics; and a survey of academic year 2012/13 applicants who considered or chose physics. This report summarises the findings from all three of these phases.

This summary highlights the key insights to have emerged from this comprehensive study of issues ranging from what attracts young people to physics and how they obtain information at crucial decision junctures, to the potential impact of higher tuition fees and debt.

Overview
The evidence indicates that, in terms of undergraduate degree applications, physics is in a strong position. It attracts passionate, curious and intelligent young people from an early age, and enjoys a very positive reputation. These young people perceive the subject to be prestigious, important and fundamental, and studying it is viewed as a mark of intelligence. These positive attributes should be celebrated because they are part of the attraction of physics for young people.

However, more work must be done to publicise the rewards of studying for a physics degree and, in particular, the variety of career paths that a physics degree opens to a young person. Higher tuition fees and debt levels also pose a threat to recent progress on diversity in the subject.

\(^4\) In academic years 2009/10 and 2010/11.
Interest starts early and teachers are key influencers
Interest in physics starts as early as the age of eight and tends to solidify around GCSE level. Potential young physicists are eager for information about the subject and turn to a wide range of information sources with enthusiasm; however, school teachers are the key influencers at this stage. We therefore recommend working with teachers from primary school onwards to encourage young people to be further exposed to exciting areas of physics, such as the origins of the universe, which may help them aspire to study physics at future levels. We further recommend that IOP raises awareness of its excellent information resources, particularly those that are freely available online.

Degree subject choice solidifies over time and is influenced by teachers and course materials
Most decisions about degree subject choice are made after GCSE level, and again, school teachers and careers advisors are the key influencers. At this stage, young people also make intensive use of resources provided by higher-education institutions, particularly degree-course information\(^5\), to investigate potential degree subjects. However, while young people are eager for information, the tendency is to under-utilise what is available. It is important to acknowledge that some of our findings in regard to information seeking (in terms of both subject choice and physics careers) appear contradictory, in that, although most young people do not investigate physics careers in detail when deciding whether to pursue a physics degree, they also state that they would like more information on physics careers.

Our conclusion is that while applicants do not wish to be bombarded with careers information while making subject choices, they do want relevant information from trustworthy sources to be easily available if they decide that they need it. We therefore recommend that efforts to work with teachers and careers advisors to disseminate information about the attractions and benefits of studying for a physics degree continue and are built on. Moreover, because degree-course availability and attractiveness can impact subject choice for late deciders, we also recommend raising the already high profile of IOP’s Physics on Course\(^6\) materials via universities, schools and the internet to reach as many potential physics students as possible.

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\(^5\) Focus group discussions indicate that young people are seeking degree course information in the sense that module-specific information was not mentioned.

Degree-course structure also plays a role in subject choice, and this study investigated the relative appeal of two-year accelerated, Bachelors and integrated Masters degrees. It found that the majority of physics applicants prefer the more in-depth four-year integrated Masters degree, a trend that appears to be on the rise as applicants perceive this degree to be the most prestigious of the above types. We therefore recommend that where course development is undertaken, attention should be given to enhancements that give the student the opportunity to combine physics with other subjects or take an industrial placement.

Young women are more likely than young men to be attracted to courses that allow them to combine physics with another subject, such as mathematics or languages, but young people may not be aware of all of the possible course combinations. Thus, young people may be encouraged to choose physics by the availability of such courses. As this is possibly less a provision than a publicity issue, we recommend raising awareness of, for example, IOP’s Physics on Course materials and features about combined courses among young women specifically, where possible.

Careers information plays a role in subject choice
Most young people consider a range of subjects, often related ones, before choosing their degree subject. Physics rejecters decide to study a different subject mainly because of a lack of sufficient interest, a perceived lack of career opportunities and/or a desire for a more vocational approach.

Insufficient clarity about the career opportunities afforded by a physics degree deters some young people from applying. Physics rejecters frequently claim that “more information” could have altered their decision in favour of physics. The easy availability of high-quality careers information is therefore crucial.

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7 Focus group discussions also indicate a desire for combined courses that offer a true integration of subjects, and not just a combination of separate modules.
8 Rejecters are Phase 3 respondents who considered applying for a physics course but chose not to apply for one.
Finally, young people are not completely satisfied with the careers information currently available, and this study investigated the additional information that young people desire and the sources that they consider to be trustworthy. There is a high level of demand for more-detailed information, such as job descriptions and expected salaries, and employers and physics graduates are seen as trustworthy information channels. On this basis, **we recommend enhancing existing careers information by the addition of job descriptions including salary estimations, events that enable direct interaction between physics employers and young people who are considering physics, and talks or question-and-answer sessions with physics graduates.**

**Reputation is important and physics is well regarded**
YouthSight has found that reputation and prestige are increasingly important drivers of institution choice, a trend precipitated by (and likely to increase with) the introduction of higher university tuition fees\(^9\). Young people who consider studying physics are particularly encouraged to do so by reputational considerations, with institution reputation considered to be very or quite important by 92% of respondents and course/department reputation is considered very or quite important by 90% of respondents.

While most young people who consider studying physics do so because they enjoy and excel at it, the social normative values associated with the subject are important to a large majority (83%) of applicants. Fortunately, physics has a very strong and positive reputation among young people. Participants in our study see it as prestigious, fundamental, important and difficult, and feel that its degree of difficulty bestows status on those who study it. A physics degree is viewed as a mark of intelligence, and the “geekiness” associated with it is largely seen to be beneficial. **We therefore strongly recommend celebrating and profiling these positive aspects of physics, particularly its fundamental nature and ability to explain the seemingly mysterious, because they are an essential part of the initial attraction of physics for young people.**

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\(^9\) As evidenced by YouthSight’s recent survey, which found that young people are focusing more on quality, reputation and return on educational investment. YouthSight 2012 *The 2012 Applicant Survey* (YouthSight, London).
Lack of diversity is a reputational threat
Physics has an image problem in terms of being seen as male-dominated. Young men and young women alike report this as being discouraging, but while it does not prevent young men from choosing to study physics, a minority of young women instead select less “male-dominated” subjects such as biology and medicine. An inescapable conclusion is that physics is still not as diverse as it could be, and its male-dominated image continues to discourage some young women. We therefore recommend both trumpeting achievements in diversity as well as redoubling the efforts that have increased diversity over the past few years. One potential method is to increase the number of accessible and interesting female role models in the public domain, for example, by helping female physicists to raise their public profile.

Higher fees are a threat to diversity in physics
This study shows that while higher fees are unlikely to have a significant impact on the overall number of applicants choosing to study physics, higher fees are likely to have a disproportionately negative impact on young people from “non-traditional” physics backgrounds, particularly women, but also those from ethnic minority backgrounds and those from lower Widening Participation POLAR\(^\text{10}\) quintiles. In addition, our research suggests that, although student debt itself appears to have a less negative impact on diversity than higher fees, debt is one further factor that impacts women more than men. The Phase 2 findings reveal that there is also a risk that female and ethnic-minority students and those from lower Widening Participation quintiles taking four-year courses may end their studies after three years\(^\text{11}\), impacting the “educational pipeline” into advanced physics studies and, consequently, diversity in the subject. It is therefore clear that the situation warrants careful monitoring to maintain recent progress on diversity.

\(^{10}\) Participation of Local Areas: a classification of areas across the UK, available from the Higher Education Funding Council for England, illustrating how the chances of young people entering higher education vary by where they live.

\(^{11}\) Where this is a course option.
Bursaries and scholarships play a role in debt reduction for a sizeable minority, but not as large a role as might be expected. This is in part because university prestige and, to some extent, taking a course that promises higher earnings potential are the primary responses to higher fees. However, bursaries and scholarships could attract physics applicants from ethnic minority and lower Widening Participation quintiles (and possibly female applicants, who are more worried about future debt\textsuperscript{12}). \textbf{We therefore recommend that such schemes continue to be actively marketed to women, ethnic minorities, those from lower social grades and/or those living in areas with an historically low level of participation in higher education.}

\textsuperscript{12} Our 2011/12 Higher Expectations study, which is not in the public domain, shows that there is a statistically significant difference between the genders, with young women slightly more worried about debt than young men. Based on a sample of 4414 first-year undergraduates (i.e. 2011/12 starters), it found that 28\% of female respondents were “very concerned” about building up student loan debt, compared with 21\% of male respondents. Furthermore, Phase 3 of this study found a consistent pattern in this regard: young women showed higher levels of concern across a range of questions and response items, not just one or two isolated items.
THE INITIAL ATTRACTION TO PHYSICS

This chapter considers the following questions:
• What attracts young people to physics?
• How old are they when their interest is first sparked?
• Which areas of physics catch their imagination?
• What sources of information or entertainment attract them to physics?

Figure 1: Age at which interest in physics develops

Based on focus groups with university applicants, students and graduates interested in physics. The size of the bubbles indicates the ages that were discussed most frequently as the age at which focus group participants first became interested in physics. However, since qualitative samples are small, these findings are indicative.

“When I was between about 8 and 10, I’d watch Discovery Channel programmes on the solar system.”

Physics applicant

“...I think it was more of a gradual process... It was when I studied GCSEs that I realised physics was my favourite science.”

Undecided applicant

Please note that the findings in this chapter are based solely on the focus group work carried out for Phase 2 of this study.

Developing an interest in physics
Our focus group work suggests that for most young people an interest in physics develops through a gradual process that begins with a general interest in science and mathematics at an early age (8–10 years old). This tends to progress (figure 1) into a passion for physics that emerges once the young person studies it in greater depth at school, particularly at GCSE level (although a minority are captivated by physics earlier). The finding that GCSE/lower sixth form is a key juncture in the educational pipeline is corroborated by a 2007 study carried out for IOP.

The initial curiosity in physics is usually inspired by an intrinsic interest in science, problem-solving and understanding how things work. Specific areas of physics that spark the most interest are space and the solar system, astronomy, particle physics and the work at CERN, chaos theory, quantum physics, and cosmology. This agrees reasonably well with the findings of a 2007 survey that the “three most popular subject areas that first-year undergraduate students cited as being of ‘significant interest’ in terms of attracting them to study physics were: particles and quantum phenomena (72%), nuclear physics (61%) and astrophysics (53%)”.

Other people in the young person’s environment also exert a strong influence. School teachers are by far the most powerful sources of inspiration.

13 The concept of the educational pipeline was used to analyse the attrition of young people from academic study of chemistry and physics in Elias et al. 2006 Representation of Ethnic Groups in Chemistry and Physics (The Royal Society of Chemistry and the Institute of Physics, London).
15 The Institute of Physics 2009 Particle Physics – It Matters: A Forward Look at UK Research into the Building Blocks of the Universe and its Impact on Society (The Institute of Physics, London).
Based on focus groups with university applicants, students and graduates interested in physics.

The size of the bubbles indicates the sources of influence discussed most frequently and/or with most passion by focus group participants. However, since qualitative samples are small, these findings are indicative.

**Figure 2: People who serve as sources of information about physics**

- **TEACHERS AND SCHOOL**
  - inspiring teachers
  - guest speakers
  - school trips

- **FRIENDS**

- **FAMILY**

- **OPEN DAYS**

**Sources of information about physics**

When young people first seek out information about physics, it is teachers to whom they turn most often (figure 2). Beyond teachers and family members, young people also obtain information about physics from a blend of books, magazines, TV programmes and documentaries, and the internet. While the internet is certainly a popular source of information on physics, it should be noted that young people use all of the above sources enthusiastically.

Information made available by IOP, particularly via its website\(^\text{16}\), along with IOP’s membership magazine *Physics World* (and the accompanying website and smartphone app), are also seen as valuable resources. However, only the most dedicated physics enthusiasts appear to be aware of these.

**Conclusions and recommendations**

Interest in physics tends to solidify around GCSE level. GCSE grades are the first hurdle in the “educational pipeline” into degree-level physics\(^\text{17}\) and teachers are the key influencers at this stage. We therefore suggest that efforts are made to work with teachers from primary-school level onwards.

However, the sources of information offered by IOP do not currently reach everyone in its target audience. We therefore recommend that IOP raises awareness of its excellent online resources, for instance, via a search-engine optimisation campaign, which focuses on keyword combinations that reinforce positive associations with physics, for example, creative energy, infinity, the universe, space, exploration, the sub-atomic world and cutting-edge technology\(^\text{18}\).

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\(^{16}\) www.iop.org  
\(^{17}\) Elias et al. Representation of Ethnic Groups.  
This chapter considers the following questions:

- When are decisions made about which degree subject to study at university?
- What leads young people to apply to study physics at university?
- What sources of information do they use when deciding on a degree subject?
- Which course structures do physics applicants prefer?

Figure 3: Age at which degree subject decision is made

Based on focus groups with university applicants, students and graduates interested in physics.

Choosing to study physics at degree level

Most young people tend to decide on their subject of study before they decide on the university they want to attend, usually during the post-GCSE years, though some do decide at the last moment (figure 3). The decision is usually based around interest and ability in a subject, but for those who are still undecided by the time they begin investigating universities, course structure and availability exert an influence on subject choice.

When deciding on a degree-course subject, physics students are far more focused on their passion for and ability in the subject than the average UK undergraduate. The latter, while still considering these factors to be important, place greater emphasis on employability and career prospects (table 1). Those studying close rival subjects such as mathematics and chemistry are also more likely than average to focus on passion for and ability in their subject of choice.

Sources of information used to investigate degree subjects

While many young people do consult their parents about what to study, it is physics teachers and careers advisors who emerge as key sources of influence on this decision.

However, nearly a quarter of applicants surveyed\(^{19}\) (23%) said that no-one encouraged them to study physics. As demonstrated in figure 4, this applies particularly to those from the lowest Widening Participation POLAR quintile\(^{20}\), who are significantly more likely than those from other POLAR quintiles to state that no-one encouraged them to study physics. While this can be interpreted to mean that many who choose physics really are passionate and dedicated, it also suggests that some young people – especially those from backgrounds where they are less likely to enter higher education – are not receiving sufficient encouragement.

\(^{19}\) Phase 3 applicant survey.
\(^{20}\) Those in the lowest Widening Participation POLAR quintile are least likely to enter higher education; please see under “Definitions” in the initial “Background and information” section for more details.
Table 1: Reasons for undergraduates’ choice of course subject

<table>
<thead>
<tr>
<th>Answers</th>
<th>Subject groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UK average for all subjects (22,101)</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Loved the subject</td>
<td>69%</td>
</tr>
<tr>
<td>My best subject(s) at school</td>
<td>31%</td>
</tr>
<tr>
<td>I needed it to enter my chosen career</td>
<td>29%</td>
</tr>
<tr>
<td>Thought it would help my career</td>
<td>29%</td>
</tr>
<tr>
<td>Leads to a well paid job</td>
<td>26%</td>
</tr>
<tr>
<td>Better guarantee I will get a job when I graduate</td>
<td>22%</td>
</tr>
</tbody>
</table>

Q: What were the primary reasons you chose the course subject you are currently studying?

Statistically significant differences: a green background indicates that this figure is significantly higher than any figure in the same row in purple. Instances where figures for competitor subject are significantly higher than the UK average are also in green. (Respondents provided multiple answers to this question.)

Figure 4: Individuals who encourage young people to study physics, by Widening Participation POLAR quintile

- physics teacher: top influence
- public role models, e.g. TV presenters, writers
- no-one
- parents/guardians/carers
- friend
- guest speakers, e.g. at school
- non-physics teacher
- other family member
- brother/sister
- family friend

Base: all Phase 3 respondents, n = 530 (rejecters n = 278, accepters n = 252) (lowest 20% = 48, next lowest 20% = 68, top 60% = 377)
Q: Who, if anyone, encouraged you to study physics at university?
Beyond talking to others, key information sources for young people investigating a degree subject are universities, along with web searches (figure 5). There is some dissatisfaction in this area, with young people saying they want more detail on course content, topics covered and information about courses that combine physics with other subjects, whether as a normal combination or as a major/minor.

**Course-structure preferences**

There is a clear preference across the board for three- and four-year course structures, with physics accepters slightly more likely than rejecters to choose a four-year integrated Masters course (figure 6). In the discussions that accompanied the development of the higher-education reforms in England, some expressed interest that accelerated two-year degrees were being considered as an option. This option was therefore explored as part of this study, but both the focus group work and survey findings suggest little demand for such courses in physics.

Young people who do not fit the “traditional” physics student profile are more likely to choose a three-year course; in particular, this remark applies to those from ethnic-minority backgrounds (47% vs 34% of white applicants) and from the lowest Widening Participation quintile (46% vs 26% from the second-lowest quintile and 38% of those from the top three quintiles). However, these differences by ethnicity and socio-economic group towards the three-year course are not seen in Higher Education Statistics Agency (HESA) data on the degree choices of first-year physics students, where similar proportions select the three-year course regardless of background.

Our focus group work indicates that three-year courses are perceived as quicker, cheaper, more flexible and having lower entry requirements, while four-year courses are seen to offer more depth and prestige. The MPhys/MSci receives such strong consideration not only because integrated Masters degrees are perceived to confer better job prospects and to be becoming the norm, but also because they offer greater depth and an opportunity to continue learning, i.e. the MPhys/MSci is increasingly seen as the requisite qualification to enable PhD study in the UK (figure 7).

**Figure 5: Sources of information when investigating a degree subject**
This is a statistically significant difference.
There is a statistically significant difference between those in the lowest and the next-lowest quintiles.

**Figure 6: Course structures applied for**

<table>
<thead>
<tr>
<th>Course Structure</th>
<th>Accepters</th>
<th>Rejecters</th>
</tr>
</thead>
<tbody>
<tr>
<td>FE college course</td>
<td>1%</td>
<td>0%</td>
</tr>
<tr>
<td>2-year foundation course</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>2 + 2 course at the Open University</td>
<td>1%</td>
<td>0%</td>
</tr>
<tr>
<td>3-year Bachelors course</td>
<td>0%</td>
<td>33%</td>
</tr>
<tr>
<td>4-year course (only asked of physics rejecters)</td>
<td>0%</td>
<td>55%</td>
</tr>
<tr>
<td>4-year MPhys/MSci (only asked of physics accepters)</td>
<td>0%</td>
<td>63%</td>
</tr>
<tr>
<td>4-year sandwich course*</td>
<td>11%</td>
<td>18%</td>
</tr>
<tr>
<td>Combined course (physics plus another subject)</td>
<td>10%</td>
<td>21%</td>
</tr>
<tr>
<td>Other</td>
<td>4%</td>
<td>10%</td>
</tr>
</tbody>
</table>

Base: all Phase 3 respondents, n = 530 (rejecters n = 278, accepters n = 252)
Q: Which course structures best describe the courses you’ve applied for?
* A four-year sandwich course is generally an undergraduate course with a placement year

**Figure 7: Reasons for considering the MPhys/MSci route**

- **MPhys/MSci gives better career prospects than “just” a Bachelors**
- It’s expected these days; it’s the norm
- It’s better to do an MPhys/MSci on a student loan than pay out of pocket for a Masters
- More in-depth study, chance to do research project
- To continue studying, joy in learning

Based on focus groups with university applicants, students and graduates interested in physics.
The size of the bubbles indicates the reasons for considering the MPhys/MSci route that were discussed most frequently and/or with most passion by focus group participants. However, since qualitative samples are small, these findings are indicative.

21 This is a statistically significant difference.
22 There is a statistically significant difference between those in the lowest and the next-lowest quintiles.
Women are significantly more likely to choose combined courses than men (19% vs 11%). In our focus groups, the subject mentioned most frequently as being desirable in combination with physics was mathematics, although engineering, geography and languages were also discussed. In addition, some young people were aware that one or two universities offered their desired combination (e.g. physics and a language), but these institutions were not the preferred choice for other reasons (such as being too far away from home). Both traditional combined courses and US-style major/minor combinations were discussed.

Aside from expressing a wish for more combined courses, young people also want degree programmes that improve their employability (figure 8).

Not all students on four-year courses go on to complete the fourth year. In Phase 3 of this study, one in five applicants said that higher levels of student debt may cause them to consider finishing after three years. Thus, there is a chance that the natural rate of attrition on such courses may start to rise with higher fees. As can be seen in figure 9, this applies particularly to female applicants to four-year courses, who are significantly more likely than their male counterparts to say that debt might make them stop studying after three years. This pattern is also seen among ethnic-minority applicants and those from lower social grades, but these differences are not statistically significant.

Figure 8: What young people want in terms of course structure

Based on focus groups with university applicants, students and graduates interested in physics. The size of the bubbles indicates the combined course structures that were discussed most frequently and/or with most passion by focus group participants. However, since qualitative samples are small, these findings are indicative.

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24 This was not a focal point of the study and we did not quantify what proportion end their studies prematurely or at what point they end them, for example, after three years with a Bachelors degree.

25 Where that is an option.

26 This is not to say that such attrition causes students to drop out of the course, but rather that they perhaps complete a Bachelors degree rather than an integrated Masters degree.
Conclusions and recommendations

Most decisions about degree subject choice are made post-GCSE, and school teachers and careers advisors are the key influencers of these decisions. Universities are also an important information channel. As young people are keen to obtain information yet tend to under-utilise what is available\(^27\), we recommend that relevant bodies work even more closely with physics/science teachers and careers advisors to disseminate information about the attractions and benefits of studying for a physics degree.

Furthermore, because young people use course information to research potential subjects, and because course availability and attractiveness impact subject choice for late deciders, we recommend that efforts be made to raise greater awareness of IOP’s Physics on Course information.

A majority of physics students prefer the apparently more prestigious four-year integrated Masters degree\(^28\). This is a trend that appears to be on the rise, with a recent IOP analysis of HESA data showing that such courses are becoming more popular among students than Bachelors-level courses; in 2004/05 the proportion of full-time first-year students that entered the integrated Masters was 42.4%, rising to 51.3% in 2009/10\(^29\). We therefore recommend that where course development is undertaken, attention should be given to enhancements that give the student the opportunity to combine physics with other subjects (see chapter three) or take an industrial placement.

The study shows that young women are more likely to be attracted to combined courses and may be encouraged to study physics by the availability of such courses. As this is possibly less an issue of provision and more one of publicity, we recommend targeting information about combined degree courses to young women.

\(^{27}\) Woodnutt et al. Repackaging Physics.

\(^{28}\) As shown in figure 6, 63% applied for the MPhys/MSci route, while 33% applied for the Bachelors route.

\(^{29}\) The Institute of Physics Statistical Report.
CHOOSING NOT TO STUDY PHYSICS AT UNIVERSITY

This chapter considers the following questions:

- Why do young people choose not to apply for a physics degree?
- What do they choose instead?
- What might have changed their minds?

Figure 10: Reasons for not studying physics at university, by gender

Reasons for choosing a different subject

Most young people consider a range of subjects, often related ones, before making their degree subject choice. The main reasons given by rejecters in deciding to study a different subject are: they are simply not sufficiently interested in physics to complete an entire degree, they perceive other subjects to offer better career opportunities and they prefer a more vocational subject. Our focus group work suggests that young people’s preference for a more vocational subject stems from a perception that physics is a theoretical, desk-bound field with less application than other subjects, while some believe that the sole career option available to them would be in (academic) science research.

---

30 i.e. those who consider studying physics at university but choose not to; see under “Definitions” in the initial “Background and information” section for a fuller explanation.
As shown in figure 10, young women are significantly more likely than young men to reject physics because they perceive it as being too difficult and/or too male-dominated. Meanwhile, young men are significantly more likely to reject it because they believe that other subjects offer higher graduate salaries and/or are more prestigious. Physics rejecters were asked whether the higher fees being introduced from the academic year 2012/13 had affected their choice of subject. For the vast majority (86%) the introduction of higher fees made no difference. Where there was an impact, young people generally employed more than one strategy. As shown in figure 11, these strategies took the form of seeking out subjects perceived to offer better career opportunities, higher graduate salaries, higher lifetime earnings and greater flexibility.

Finally, although the differences are not statistically significant, applicants from ethnic-minority backgrounds and lower social grades appear to be more likely to switch to a different subject because of higher fees.

Subjects chosen instead of physics
The top five subjects chosen by physics rejecters are engineering, biological sciences, mathematics, chemistry and medicine/dentistry (figure 12). These findings are broadly in line with statistics recently published by IOP on the degree-course destinations of accepted applicants with physics and mathematics A-levels in 2011, in which the top degree subjects, other than physics, of students holding combinations of physics, mathematics and further mathematics A-levels were found to be engineering (e.g. civil, aerospace, mechanical, electrical and electronic), mathematics, chemistry, preclinical medicine, computer science and economics.

Women are significantly more likely than men to apply for biological sciences (19% vs 11%). Ethnic-minority applicants are significantly more likely than white applicants to apply for engineering (33% vs 23%) and medicine/dentistry (17% vs 7%), which is corroborated in the 2006 ethnicity study by IOP and the Royal Society of Chemistry.

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31 This study did not enquire why young women are more likely than young men to have the impression that physics is too difficult.
32 The Institute of Physics 2011 Degree-Course Destinations of Accepted Applicants with Physics and Mathematics A-level or Scottish Higher 2006–11 (The Institute of Physics, London).
33 Elias et al. Representation of Ethnic Groups.
Figure 12: Subjects chosen by physics rejecters

- engineering: 31%
- biological sciences (including sports science & psychology): 20%
- mathematics & mathematical sciences: 19%
- chemistry: 12%
- medicine & dentistry: 10%
- computer science: 7%
- combined programme or joint honours: 7%
- broadly based programmes in the physical sciences: 6%
- business & administrative studies: 5%
- economics: 4%
- geography: 4%
- architecture, building & planning: 1%
- education (including teaching): 1%
- other: 9%

Base: Phase 3 rejecters, n = 278
Q: Which subjects have you applied to study at university?

Figure 13: Incentives that might have convinced rejecters to choose physics

- better idea of careers possible with a physics degree: 54% men, 62% women
- more opportunities to combine physics with other subjects: 43% men, 41% women
- more information about course content: 22% men, 21% women
- better course content: 21% men, 18% women
- more women studying physics at school/college/university: 14% men, 14% women
- more female role models in physics: 15% men, 15% women
- more physics role models generally: 12% men, 12% women
- other: 13% men, 13% women

Base: Phase 3 rejecters, n = 278 (male n = 129, female n = 149)
Q: What would have convinced you to study physics?
What might have changed their minds?
Having a better idea of possible careers and the ability to take physics in combination with another subject (see figure 13) are the two main factors that physics rejecters state could have convinced them to apply for a physics degree — although these are not among the top reasons for choosing a different subject instead. Despite role models being relatively unimportant factors, young women are significantly more likely than young men to state that more women studying physics and more female role models might have convinced them to study physics.

Conclusions and recommendations
As one in five rejecters state that they rejected physics because careers paths for other subjects are clearer, more clarity about physics careers may increase student numbers. Since a large amount of information is already available, for instance on the IOP website and in university course descriptions, our recommendation is to work more closely with teachers and careers advisors to disseminate information more widely about the attractive careers that are open to those with a physics degree.

Promotion of existing informational materials is thus a recurring theme, and the previously recommended internet promotions could therefore also be useful in boosting awareness of IOP’s careers resources.

Promoting more female role models in physics and highlighting case studies of women who are studying physics may also encourage some female rejecters to change their minds. This is discussed more extensively in chapter four, which focuses on subject reputation.
This chapter considers the following questions:

- How important is subject reputation?
- What is the reputation of physics as a subject?

### Table 2: Net importance of different reputation factors in institution choice (very or quite important)

<table>
<thead>
<tr>
<th>Answers</th>
<th>Subject groups</th>
<th>UK average for all subjects (10,764)</th>
<th>Physics and astronomy (157)</th>
<th>Preclinical medicine (155)</th>
<th>Chemistry (131)</th>
<th>Maths (250)</th>
<th>Computer science (252)</th>
<th>Engineering (285)</th>
</tr>
</thead>
<tbody>
<tr>
<td>University reputation, overall</td>
<td>78%</td>
<td>84%</td>
<td>91%</td>
<td>91%</td>
<td>81%</td>
<td>81%</td>
<td>85%</td>
<td></td>
</tr>
<tr>
<td>Reputation of course/department/lecturer</td>
<td>72%</td>
<td>80%</td>
<td>80%</td>
<td>75%</td>
<td>67%</td>
<td>69%</td>
<td>72%</td>
<td></td>
</tr>
<tr>
<td>Traditional and solid reputation</td>
<td>60%</td>
<td>71%</td>
<td>75%</td>
<td>72%</td>
<td>67%</td>
<td>63%</td>
<td>68%</td>
<td></td>
</tr>
<tr>
<td>Strong in league tables</td>
<td>57%</td>
<td>77%</td>
<td>75%</td>
<td>71%</td>
<td>72%</td>
<td>66%</td>
<td>68%</td>
<td></td>
</tr>
<tr>
<td>Research reputation</td>
<td>52%</td>
<td>78%</td>
<td>61%</td>
<td>71%</td>
<td>46%</td>
<td>59%</td>
<td>58%</td>
<td></td>
</tr>
<tr>
<td>Seen as being a prestigious place to go to</td>
<td>50%</td>
<td>65%</td>
<td>66%</td>
<td>67%</td>
<td>62%</td>
<td>59%</td>
<td>59%</td>
<td></td>
</tr>
</tbody>
</table>

Base: all UK fee payers answering in our (unpublished) Higher Expectations study 2009/10; n = 10,764

Q: How important were each of these factors in your decision about which university to choose?

Statistically significant differences: a green background indicates that this figure is significantly higher than any figure in the same row with the purple background. Instances where figures for competitor subject are significantly higher than the UK average are also highlighted green. (Respondents provided multiple answers to this question.)

---

**The importance of subject reputation**

Physics students are far more conscious of, and influenced by, institutional reputation than the average UK student (84% vs 78%), as are most students of “close rival” subjects (see table 2). However, we expect this difference to fade with the introduction of higher fees, which are driving applicants across the board towards more prestigious institutions and/or those with better reputations for employability. Physics students are also far more likely than the average UK student to state that an institution’s research reputation is important (78% vs 52%).

In our survey of university applicants, which focused specifically on subject reputation, institution reputation and course/department reputation were considered very or quite important by 92% and 90% of respondents, respectively, compared with 83% for subject reputation. It is interesting to note that applicants in our study gave higher overall “net” importance ratings to reputation factors (a range of 83% to 92%), compared with a net importance range of 65% to 84% in the Higher Expectations study, which was conducted with first-year university students in the academic year 2009/10. The implication is that reputation is gaining in importance for young people.

**Physics: a prestigious, fundamental and challenging subject**

Physics has a very strong reputation: as shown in figure 14, most applicants see it as prestigious, well respected, fundamental and important. It is also viewed as being one of the most challenging subjects, although this – and the “geekiness” associated with it – is largely seen in a positive light.

While it can be argued that the term “geek” is pejorative, this is by and large not the perception among young people. Most young people see “geekiness” as a positive reputational aspect (77%), with only a minority viewing it as a negative one (14%).

---

34 YouthSight 2012 Applicant Survey.
35 Phase 3 of this study.
36 Net importance is the sum of responses for ‘very important’ and ‘quite important’.

“I do matter to me that physics has a prestigious reputation because employers look very favourably on it.”

Undecided applicant

“Physics is very respected like most sciences, helped by high-profile projects.”

Non-physics student

“Big. Enormous. Powerful. Practically everything depends on physics.”

Non-physics student
Our focus group work also indicates that, while a minority of research participants feel shunned socially, most note that this is not their experience and are proud of their ability. Research carried out for IOP in 2007 corroborates this view, with the authors concluding that “communications should throw down the gauntlet and offer challenge and intrigue: the student who chooses physics at degree level should be complimented.”

Our Phase 3 survey work suggests that young people believe that having a physics degree offers many advantages (figure 15). We would argue that these advantages tend to outweigh concerns about “geekiness” because one of the advantages is that those holding a physics degree are seen as being more intelligent by employers and others. Additional perceived advantages include having skills that many other graduates do not (e.g. numeracy and a problem-solving approach) and a wider range of career options (which, interestingly, contrasts with the comments in the previous section by rejecters who claimed career paths for physics were not that clear to them).

Figure 14: The reputation of physics

<table>
<thead>
<tr>
<th></th>
<th>strongly agree</th>
<th>agree</th>
<th>neither agree nor disagree</th>
<th>disagree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>prestigious/well respected subject</td>
<td>53</td>
<td>40</td>
<td>6 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a fundamental/important subject</td>
<td>52</td>
<td>38</td>
<td>6 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>one of the hardest subjects</td>
<td>47</td>
<td>40</td>
<td>9 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>male-dominated</td>
<td>25</td>
<td>50</td>
<td>12 7 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nerdy/geeky but in a good way</td>
<td>24</td>
<td>53</td>
<td>17 4 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>nerdy/geeky but in a bad way</td>
<td>2</td>
<td>12</td>
<td>21</td>
<td>37</td>
<td>25</td>
</tr>
</tbody>
</table>

Base: all Phase 3 respondents, n = 530
Q: What reputation does physics have as a subject?
All figures are in percentages

37 Greg Rowland Semiotics Semiotic Analysis p22.
Physics: widely perceived as male-dominated
Although physics has a very strong and positive reputation among young people, large majorities of them also perceive it to be male-dominated (figure 16). Moreover, women are significantly more likely to espouse this view than men.

Women are also significantly more likely than men to view physics as “one of the hardest subjects”. As discussed in chapter three, these two aspects of subject reputation discourage some – but clearly not all – women from applying to study physics at degree level.

However, the situation is slightly more nuanced than these proportions imply: in our focus groups, most men expressed a desire to see more women studying physics, while some women said that they welcome the challenge of being in the minority and consider it an advantage in cases where potential employers actively seek diversity.

The perception that physics is a male-dominated field does agree with the reality. Physics students are more likely than the average UK student to be young\textsuperscript{38}, male and from AB backgrounds, and to have university-educated parents\textsuperscript{39}. Those who study “close rival” subjects tend also to have a less diverse profile than the UK average, but the case is more extreme for physics (and engineering).

\textsuperscript{38} I.e. not of an age at which a student is considered to be a mature student.

\textsuperscript{39} Based on HESA data analysed by the Institute of Physics (Statistical Report), and fieldwork with 22,226 first-year undergraduates that constituted Phase 1 of this study.
Conclusions and recommendations
Reputation and prestige drive institution choice, which is a trend that our 2012 Applicant Survey indicates is likely to increase with the introduction of higher university tuition fees as young people focus on quality and return on educational investment\textsuperscript{40}. Young people who choose physics are particularly encouraged to do so by reputational considerations.

Overall, physics enjoys a very strong and positive reputation among young people, and its degree of difficulty is seen to bestow status on its students. The subject is viewed as prestigious, fundamental and difficult. A physics degree is seen as a mark of intelligence, and the “geekiness” associated with it is largely perceived as beneficial. We recommend celebrating and profiling these positive aspects of physics, particularly its fundamental nature and ability to explain the seemingly mysterious, because these comprise part of the initial attraction for young people.

However, to an extent, physics continues to have an image problem in terms of being seen as male-dominated. Both young men and young women find this discouraging, but while it does not prevent young men from choosing to study physics, there is evidence that a minority of young women are choosing less “male-dominated” subjects. Nevertheless, physics is gradually growing more diverse: for instance, the proportion of female full-time first-year undergraduates increased from 18% to 21% between 2004/5 and 2009/10\textsuperscript{41}. Despite this, it is clearly still not as diverse as it could be, and its image as male-dominated remains discouraging to young women.

We therefore recommend both highlighting current achievements in diversity as well as redoubling the efforts that have increased diversity in recent years. One possibility is to increase the number of accessible and interesting female role models in the public domain, for example, by helping female physicists to raise their public profile. We further recommend that, since teachers are a key point of influence both on A-level and on university subject decisions, they have a vital role to play in encouraging “non-traditional” physics candidates to choose the subject.

\textsuperscript{40} YouthSight 2012 Applicant Survey.
\textsuperscript{41} Institute of Physics Statistical Report p7.

---

**Figure 16: Gender differences in perceptions of reputation**

<table>
<thead>
<tr>
<th>Perception</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nerdy/geeky in a good way</td>
<td>77%</td>
<td>77%</td>
</tr>
<tr>
<td>Nerdy/geeky in a bad way</td>
<td>11%</td>
<td>17%</td>
</tr>
<tr>
<td>Male-dominated</td>
<td>70%</td>
<td>80%</td>
</tr>
<tr>
<td>One of the hardest subjects</td>
<td>81%</td>
<td>92%</td>
</tr>
</tbody>
</table>

Base: all Phase 3 respondents, n = 530
Q: What reputation does physics have as a subject?
The Potential Impact of Higher Fees and Debt Levels

This chapter considers the following questions:

- Will higher tuition fees and debt affect the number of young people studying physics?
- How concerned are young people about student debt?
- Are there variations in the impact of higher tuition fees and levels of debt?
- What is the role of bursaries and scholarships in offsetting costs?

Table 3: Impact of cost on 2010/11 first-year undergraduates

<table>
<thead>
<tr>
<th>Answers</th>
<th>Subject groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UK average for all subjects (3752)</td>
</tr>
<tr>
<td>A lot – I considered not going to university because of cost</td>
<td>23%</td>
</tr>
<tr>
<td>Some – cost factored in my decision</td>
<td>47%</td>
</tr>
<tr>
<td>Not at all</td>
<td>29%</td>
</tr>
<tr>
<td>Don’t know</td>
<td>1%</td>
</tr>
</tbody>
</table>

Base: all UK fee payers answering in our (unpublished) Higher Expectations study 2010/11
Statistically significant differences: a green background indicates that this figure is significantly higher than any figure in the same row with the purple background. Instances where figures for competitor subject are significantly higher than the UK average are also highlighted green.

The impact of higher tuition fees

Current first-year physics undergraduates are less price-sensitive than the average UK student and most students of “close rival” subjects, except preclinical medicine students, who are even less price-sensitive. This observation refers to the extent that prevailing prices (i.e. £3375 for full-time students) played a role in the physics students’ decision to attend their current institution, and to their responses to questions about hypothetical scenarios involving higher fees (table 3). In considering hypothetical scenarios, physics students anticipate tuition fees towards the higher end of the fee spectrum. Furthermore, they are less likely than the average UK student – even at this higher end – to be put off entering higher education by higher fees.

Nearly a quarter of first-year 2010/11 undergraduates considered not entering higher education because of the cost, but did so anyway. Physics students, on the other hand, were far less likely than average to have considered not going to university (15%) and were significantly more likely to state that cost had no effect on their decision.

When we put the same question to university applicants due to start in 2012/13, a similar proportion (16%) of physics accepters said that they considered not going to university because of the cost, and 55% said that the cost had no effect on their decision. This is despite the maximum fee cap almost tripling.

There are, however, diversity implications. As demonstrated in figure 17, female applicants were significantly less likely than male applicants to state that cost played no role in their decision.
Furthermore, ethnic minority applicants were significantly more likely than white applicants to say that they considered not going to university at all because of the cost, as were those from lower social grades (16% vs 8% of those in higher social grades). This latter finding is corroborated by recent evidence that the greatest impact of tuition fees is on those from lower socio-economic groups45. It should be noted that the sample sizes for ethnic minority applicants in this study were relatively small, which did not allow for analysis of the behaviours of individual ethnic minority sub-groupings.

As demonstrated in figure 18, applicants whose decision was affected by cost said that they intended to apply to a more prestigious university to increase their earning potential (47%), to courses that promise a higher income (33%) or to universities closer to home (29%). Physics accepters, however, were significantly more likely to apply to more prestigious universities than rejecters, as shown in the figure.

This emphasis on increased earning potential and prestige echoes the conclusions of our 2012 Applicant Survey46, which found that the most common reaction among young people due to start university in academic year 2012/13 was related to the “quality” of the institution and placing importance on “return on investment”.

Figure 17: Impact of cost on decision to attend university, by gender and ethnicity

![Graph showing impact of cost on decision to attend university](image)

Base: all Phase 3 respondents, n = 530 (male n = 256, female n = 274; white n = 421, non-white n = 109)
Q: To what extent did cost affect your decision about whether or not to go to university?

<table>
<thead>
<tr>
<th></th>
<th>women</th>
<th></th>
<th>men</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12%</td>
<td>37%</td>
<td>14%</td>
</tr>
<tr>
<td>a lot – considered not going</td>
<td>1%</td>
<td></td>
<td>1%</td>
</tr>
<tr>
<td>some – cost factored in my decision</td>
<td></td>
<td>50%</td>
<td>1%</td>
</tr>
<tr>
<td>not at all</td>
<td></td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>don’t know</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>19%</td>
<td>31%</td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>non-white</td>
<td>19%</td>
<td>31%</td>
<td>11%</td>
</tr>
<tr>
<td>a lot – considered not going</td>
<td>1%</td>
<td></td>
<td>1%</td>
</tr>
<tr>
<td>some – cost factored in my decision</td>
<td></td>
<td>49%</td>
<td>1%</td>
</tr>
<tr>
<td>not at all</td>
<td></td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>don’t know</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12%</td>
<td>37%</td>
<td>14%</td>
</tr>
<tr>
<td>white</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a lot – considered not going</td>
<td>1%</td>
<td></td>
<td>1%</td>
</tr>
<tr>
<td>some – cost factored in my decision</td>
<td></td>
<td>56%</td>
<td>1%</td>
</tr>
<tr>
<td>not at all</td>
<td></td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>don’t know</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 18: Strategies applicants intend to employ to compensate for the cost of study

<table>
<thead>
<tr>
<th></th>
<th>accepters</th>
<th>rejecters</th>
</tr>
</thead>
<tbody>
<tr>
<td>applied to more reputable universities to improve earning potential</td>
<td>37%</td>
<td>29%</td>
</tr>
<tr>
<td>applied to courses where I’d be more likely to earn a higher income</td>
<td>29%</td>
<td>23%</td>
</tr>
<tr>
<td>applied to universities nearer my home</td>
<td>30%</td>
<td>28%</td>
</tr>
<tr>
<td>applied to a course that includes a work-based element, e.g. industry year</td>
<td>21%</td>
<td>23%</td>
</tr>
<tr>
<td>applied to universities where I’d get a higher bursary</td>
<td>24%</td>
<td>21%</td>
</tr>
<tr>
<td>applied to universities where I’d get a scholarship</td>
<td>21%</td>
<td>18%</td>
</tr>
<tr>
<td>applied to universities in Scotland</td>
<td>11%</td>
<td>9%</td>
</tr>
<tr>
<td>other</td>
<td>13%</td>
<td>4%</td>
</tr>
<tr>
<td>none of these</td>
<td>13%</td>
<td>4%</td>
</tr>
</tbody>
</table>

Base: all Phase 3 respondents whose decision about going to university was either affected “a lot” or “to some extent” by cost, n = 235
Q: Did the cost of university affect your choice of where to study in any of these ways?

45 YouthSight 2012 Applicant Survey.
46 Ibid.
Continuing the theme of relative price-insensitivity, it appears that physics students expect to pay higher fees (table 4). For instance, when we asked 2010/11 first-year undergraduates how much their institution would be able to charge for their course, they stated a higher than average fee compared with students in other subject groups, except preclinical medicine. Just over a third (34%) of all physics students expected that their university would be able to charge £8501–£9000 for their course, while only 16% of respondents on average felt that their institution could charge in this fee range.

### Attitudes to student debt

While fees are impacting decisions for some about whether and what to study, the majority of applicants (77%) are concerned about debt (figure 19). Despite this, many appear to be resigned to higher debt levels: a majority agreed that studying a subject they enjoy is worth it, that the debt is a necessary evil and that the repayments are reasonable. The key worries are not being able to afford to have a mortgage (33%) or to have children (16%).

There are again implications for diversity in physics, with female applicants expressing higher levels of concern about debt than male applicants. As demonstrated in figure 20, women are significantly more likely than men to worry about their ability to obtain a mortgage and to afford having children. As discussed in chapter 2, they are also significantly more likely to consider breaking off a four-year degree after three years because of high debt levels.

Perhaps not surprisingly, given the complex and shifting nature of higher-education funding, nearly a quarter (23%) of respondents say that they do not really understand the student loans system, as corroborated by our 2012 Applicant Survey, which surveyed applicants applying to all subjects. In that survey, significant minorities of applicants provided incorrect answers when asked at what salary level a student loan would have to be repaid (17%) and when it would be written off in the event of incomplete payment (24%)47. Female applicants in our Phase 3 survey were significantly more likely than male applicants to say that they do not understand the student loan system (26% vs 19%), again showing how the changes to higher-education funding are having a disproportionate impact on those who are already under-represented in physics (as is the case for other subjects).

However, this last finding may also be because women are more cautious about saying that they understand something.

### Table 4: Student views of what their institution could charge for their course

<table>
<thead>
<tr>
<th>Course fee their institution could charge</th>
<th>Subject groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UK average for all subjects (11,337)</td>
</tr>
<tr>
<td>£5000–£5500</td>
<td>38%</td>
</tr>
<tr>
<td>£5501–£6000</td>
<td>15%</td>
</tr>
<tr>
<td>£6001–£6500</td>
<td>8%</td>
</tr>
<tr>
<td>£6501–£7000</td>
<td>12%</td>
</tr>
<tr>
<td>£7001–£7500</td>
<td>5%</td>
</tr>
<tr>
<td>£7501–£8000</td>
<td>5%</td>
</tr>
<tr>
<td>£8001–£8500</td>
<td>2%</td>
</tr>
<tr>
<td>£8501–£9000</td>
<td>16%</td>
</tr>
<tr>
<td>Mean</td>
<td>£6472</td>
</tr>
</tbody>
</table>

Base: all UK fee payers answering in the Higher Expectations study 2010/11, n = 11,337

Q: From 2012, universities are likely to charge between £5000 and £9000 per year in tuition fees for undergraduate degrees. How much do you think your university will be able to charge for your course?

Statistically significant differences: a green background indicates that this figure is significantly higher than any figure in the same row with a purple background. Instances where figures for competitor subject are significantly higher than the UK average are also highlighted green.

47 YouthSight 2012 Applicant Survey.
**Figure 19: Applicant attitudes to student debt**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neither Agree nor Disagree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>studying a subject I love makes it worth the debt</td>
<td>37%</td>
<td>42%</td>
<td>13%</td>
<td>5%</td>
<td></td>
</tr>
<tr>
<td>I've got to have a degree to compete in the job market; debt is a necessary evil</td>
<td>25%</td>
<td>48%</td>
<td>14%</td>
<td>8%</td>
<td>3%</td>
</tr>
<tr>
<td>the repayments are reasonable and I won't have to repay if I'm not earning a salary</td>
<td>26%</td>
<td>43%</td>
<td>14%</td>
<td>9%</td>
<td>5%</td>
</tr>
<tr>
<td>there's nothing I can do about student debt so why worry</td>
<td>17%</td>
<td>37%</td>
<td>19%</td>
<td>19%</td>
<td>5%</td>
</tr>
<tr>
<td>everyone else with a degree will be in debt, so why worry</td>
<td>9%</td>
<td>32%</td>
<td>26%</td>
<td>22%</td>
<td>9%</td>
</tr>
<tr>
<td>I worry I won't be able to afford a mortgage because of my student debts</td>
<td>10%</td>
<td>23%</td>
<td>21%</td>
<td>25%</td>
<td>15%</td>
</tr>
<tr>
<td>my parents/carers will help me, so student debt isn't a big problem for me</td>
<td>8%</td>
<td>18%</td>
<td>20%</td>
<td>27%</td>
<td>26%</td>
</tr>
<tr>
<td>I don't really understand the student loan system</td>
<td>6%</td>
<td>17%</td>
<td>16%</td>
<td>36%</td>
<td>25%</td>
</tr>
<tr>
<td>I worry I won't be able to afford having children because of my student debt</td>
<td>5%</td>
<td>11%</td>
<td>20%</td>
<td>30%</td>
<td>29%</td>
</tr>
</tbody>
</table>

Base: all Phase 3 respondents, n = 530

Q: Which of these statements best describes your attitude towards tuition fees and student debt?

**Figure 20: Gender differences in applicant attitudes to student debt**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>worry I won't be able to afford a mortgage</td>
<td>28%</td>
<td>38%</td>
</tr>
<tr>
<td>worry I won't be able to afford having children</td>
<td>13%</td>
<td>20%</td>
</tr>
<tr>
<td>don't really understand the student loan system</td>
<td>19%</td>
<td>26%</td>
</tr>
</tbody>
</table>

Base: all Phase 3 respondents, n = 530

Q: Which of these statements best describes your attitude towards tuition fees and student debt?

There is a statistically significant difference between men and women for all of the data shown in this figure.
The role of bursaries and scholarships

As demonstrated in figure 18, applying to institutions that offer scholarships and bursaries is not among the most favoured tactics employed by applicants in response to higher fees. Institution choice continues to be driven primarily by course quality, reputation and location, and increasingly by employability prospects. Overall, only around one in five applied to institutions that offer a higher bursary (20%) or a scholarship (19%). Our focus group work suggests that the main reason for this is that many physics applicants believe they are not eligible for such schemes, as demonstrated in figure 21.

Although there are no statistically significant differences by ethnicity or Widening Participation quintile (owing to the smaller sample size for this question), it does appear that ethnic minority applicants are more likely than white applicants to apply to institutions that offer bursaries (24% vs 19%, respectively) and scholarships (25% vs 17%, respectively)\(^\text{48}\). The same holds for those from the lowest Widening Participation quintile, who appear to be more likely to apply to institutions that offer scholarships (27% for those in the lowest quintile vs 18% and 17%, respectively, in the other Widening Participation groupings).

\(^{48}\) Previous research by IOP indicates that this may not hold for all ethnic-minority applicants, but the sample size for this study is too small to allow analysis by ethnic-minority sub-groupings.
Conclusions and recommendations

While higher fees are unlikely to have a significant impact on the overall number of applicants choosing to study physics, they may have a disproportionately negative impact on young people with “non-traditional” physics backgrounds, and particularly on women. Although the debt resulting from higher fees appears to have a less negative impact on diversity compared with the higher fees themselves, this debt is simply one more factor that has a larger impact on women than it does on men. It is therefore clear that the situation warrants careful monitoring to ensure that the progress on diversity made in recent years is not reversed, reinforcing our previous recommendations in this regard.

Finally, bursaries and scholarships play a role in debt reduction for a sizeable minority, but not as large a role as might be expected. This is in part because university prestige and, to some extent, taking a course with higher earnings potential are the primary responses to higher fees. However, given that bursaries and scholarships are likely to attract physics applicants from ethnic minority and lower Widening Participation quintiles (and possibly female applicants, who tend to be more worried about debt), we recommend that such schemes continue to be targeted and actively marketed to women, ethnic minorities, those from lower social grades and/or those living in areas with historically low participation in higher education.\footnote{For instance, those from the lowest two Widening Participation quintiles; this can be determined by postcode.}
This chapter considers the following questions:

- How much careers information do young people who are considering physics at university receive, and do they want more information?
- What type of information can help them to better understand potential career paths?
- What types of careers do applicants envisage for themselves?
- How likely are they to consider a career in research?
- What skills do applicants think employers are looking for?

Based on focus groups with university applicants, students and graduates interested in physics. The balance of the scales indicates the sentiments that were expressed most frequently and/or with most passion by focus group participants. However, since qualitative samples are small, these findings are indicative.

Reseaching physics careers

Most applicants who consider physics undertake few investigations into the potential careers the subject has to offer. This behaviour is driven by the tacit knowledge that physics opens many doors, coupled with a reluctance to make career decisions too early in life (figure 22).

Our focus group work also indicates that some, but not all, young people do not talk to anyone about careers options before they go to university (figure 23). Those who do talk to someone about careers tend to consult teachers and careers advisors, again emphasising their importance as a communications channel. However, many of our focus group participants felt that schools’ careers advisors are not in touch with the real world and are incapable of offering them good advice. The advice is seen as generic and not specific to physics; this can be seen in some of the verbatim quotes shown in figure 22.

This undoubtedly partly explains why a high proportion of young people prior to deciding their university subject are not aware of the full range of careers that are possible with a physics degree.
Based on focus groups with university applicants, students and graduates interested in physics. The size of the bubbles indicates the sources of information about careers that were discussed most frequently and/or with most passion by focus group participants. However, since qualitative samples are small, these findings are indicative.

**Careers information received and desired**

Applicants who considered physics were asked how much information about careers in physics they received while deciding what to study, and whether this was a sufficient amount of information. Overall, 20% of respondents reported receiving a large amount of information, 55% received some information and 23% did not receive any information. Furthermore, 62% would have wanted more information, while 36% were satisfied with the level of information received (figure 24).

**Figure 23: Key influencers in terms of careers advice prior to university**

**Figure 24: Physics careers information received and desired**

<table>
<thead>
<tr>
<th>Yes, but I didn’t receive any</th>
<th>Yes, I received a bit but wanted more</th>
<th>Yes, I received a lot but I still wanted more</th>
<th>No, I didn’t receive any but that was fine</th>
<th>No, I received a bit but that was fine</th>
<th>No, I received a lot and that was fine</th>
</tr>
</thead>
<tbody>
<tr>
<td>45%</td>
<td>34%</td>
<td>17%</td>
<td>10%</td>
<td>6%</td>
<td>10%</td>
</tr>
<tr>
<td>17%</td>
<td>11%</td>
<td>5%</td>
<td>17%</td>
<td>14%</td>
<td>10%</td>
</tr>
<tr>
<td>12%</td>
<td>5%</td>
<td>6%</td>
<td>17%</td>
<td>15%</td>
<td>17%</td>
</tr>
<tr>
<td>10%</td>
<td>6%</td>
<td>10%</td>
<td>17%</td>
<td>10%</td>
<td>14%</td>
</tr>
<tr>
<td>5%</td>
<td>11%</td>
<td>5%</td>
<td>10%</td>
<td>6%</td>
<td>10%</td>
</tr>
<tr>
<td>10%</td>
<td>6%</td>
<td>10%</td>
<td>17%</td>
<td>15%</td>
<td>17%</td>
</tr>
</tbody>
</table>

Base: all Phase 3 respondents, n = 530

Q: While you were deciding whether or not to study physics at university, did you want more information about careers in physics?
Types of physics careers information wanted

Given that nearly two-thirds of potential physics students say that they want more information about careers in physics, the question of what they want is pertinent. The responses offered to interviewees for this question (figure 25) resulted from suggestions by our focus group participants, and it is notable that more than two-fifths of all respondents were interested in all of these options.

Physics accepters are significantly more likely than rejecters to say that they want job descriptions, information from trustworthy sources and question-and-answer sessions or talks with physics graduates.

There are also significant differences by gender, age, ethnicity and social grade: female applicants prefer job descriptions, female and ethnic-minority applicants are more enthusiastic about case studies, and those from lower social grades favour salary information.

Awareness of the careers that are possible with a physics degree

When we asked focus group participants about the types of jobs and careers that are possible with a physics degree, they mentioned non-physics careers slightly more often than physics-related careers (figure 26). Applicants who had definitely decided to study physics appeared to be aware of a much wider range of career choices than those undecided and, in particular, were more aware of research careers. Research careers were seen as the main option open to those with a physics degree.

Desirable career sectors and roles

Nevertheless, when surveyed, university applicants who have considered physics are most eager to work in physics sectors perceived to be “traditional”, such as energy, space or instrumentation, as well as engineering. Our focus groups suggest that much of this desire is driven by high-profile projects such as those at CERN, with many eager to work there.

There are gender differences in terms of sector preference, with young men significantly more attracted to “traditional” physics sectors, while young women tend towards the medical sector (figure 27).
**Figure 26: Perceptions of careers available upon acquiring a physics degree**

Based on focus groups with university applicants, students and graduates interested in physics. The size of the phrases in the word cloud indicates the careers that were discussed most frequently by focus group participants. However, since qualitative samples are small, these findings are indicative.

**Figure 27: Desirable career sectors**

<table>
<thead>
<tr>
<th>Traditional physics sectors</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>60%</td>
<td>72%</td>
</tr>
<tr>
<td>Medicine</td>
<td>35%</td>
<td>51%</td>
</tr>
<tr>
<td>Finance/banking</td>
<td>36%</td>
<td>41%</td>
</tr>
<tr>
<td>IT/Telecoms</td>
<td>21%</td>
<td>32%</td>
</tr>
<tr>
<td>Business/management</td>
<td>34%</td>
<td>34%</td>
</tr>
</tbody>
</table>

*Base: all Phase 3 respondents, n = 530
Q: Which sectors are you interested in working in after you graduate?*
When asked about what types of roles they would prefer, the primary criterion for all applicants who have considered physics is that the role is challenging and interesting. As would be expected, physics accepters are significantly more likely than rejecters to say they would like to work in roles that allow them to push theoretical boundaries in physics or to apply physics to real-world problems. However, as demonstrated in figure 28, physics accepters are also significantly more likely to say that they are interested in research roles in academia and R&D roles in industry, and are significantly less likely to be interested in “any role that pays well”.

There are gender differences here as well, with men significantly more likely than women to express interest in theoretical physics roles (55% vs 42%, respectively), applied physics roles (48% vs 36%, respectively) and “any role that pays well” (34% vs 24%, respectively).

**Perceived employer demand for skills**

Overall, the top five skills that applicants believe employers want are problem-solving (91%), intelligence (85%), team work (83%), numeracy (83%) and good knowledge of their subject (80%), as shown in figure 29. There are significant differences here between accepters and rejecters: the former tend to place far more emphasis on numeracy, an analytical approach, curiosity and programming skills, while the latter emphasise communication skills, work experience and language skills.50

**Conclusions and recommendations**

It is important to acknowledge that the findings around careers information are somewhat contradictory. On the one hand, young people do not investigate physics careers to a great extent and are confident that physics is a fairly versatile subject, but on the other hand they say that they would have liked more information. Our conclusion is that, although applicants do not wish to be bombarded with careers information while making subject choices, they do want relevant information from trustworthy sources to be easily available if they decide that they need it.

Given that a lack of clarity about careers prevents some young people from applying for physics degrees, and that those who considered but decided against it state that more information could have changed their minds, we recommend making careers information more widely available as part of any strategy that aims to raise the number of young people choosing to study physics.

---

50 This study did not investigate why some skills are considered to be more sought after than others.
This study suggests that existing careers resources can be enhanced by the addition of the following:\textsuperscript{51}:

- Job descriptions, including salary estimations, for a range of employment types that are possible with a physics degree
- Events that enable direct interaction between physics employers and young people who are considering physics
- Talks that include Q&A sessions with physics graduates.

A final conclusion is that physics applicants are more interested in academic and industry research careers than those considering “close rival” subjects, but young women are somewhat less likely to consider a career related to their physics degree.

\textbf{Figure 29: Skills that applicants believe employers want}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{skills_bar_chart.png}
\caption{Skills that applicants believe employers want}
\end{figure}

\textsuperscript{51} Based on the desires expressed by Phase 2 and 3 research participants.
YouthSight conducted a full-service project on behalf of IOP, encompassing three separate phases:

- **Phase one** consisted of a report based on data from YouthSight’s 2009/10 and 2010/11 Higher Expectations studies, which describe the decision-making process of physics students when applying to university, what they do and do not find appealing in a course and institution, course pricing and sensitivity to tuition fees.
  **Deliverables:** UK Higher Education Report – Modules 1 and 4 with customised commentary.

- **Phase two** involved five 90-minute online focus groups with prospective physics students, current students who considered physics but chose a different subject and graduates with physics degrees. It served to explore in greater depth the reasons for young people choosing to study physics, how they perceive the subject in terms of reputation and employability, their knowledge of physics careers, and their views on higher fees and levels of debt.
  **Deliverables:** Transcripts from each focus group and a full report based on the findings.

- **Phase three** was a survey of university applicants who had either applied to study physics at university (accepters) or who considered doing so but applied to a different subject instead (rejecters). It served to quantify the reasons that young people do (and do not) choose to study physics at degree level, their perceptions of physics, their awareness of careers and careers information, and their attitudes towards tuition fees and student debt. A further aim in this phase was to determine whether findings vary by gender, age, ethnicity and social grade.
  **Deliverables:** Custom tables, a spreadsheet of the verbatim from any open questions and “Other” answer categories, and a full report based on the findings.

**Sample size and composition**

**Phase one:** All participants in Higher Expectations are members of YouthSight’s student panel and are full-time undergraduates in their first year of study at UK higher-education institutions. A total of 23,552 student panel members completed Higher Expectations in 2009/10 or 2010/11.
Phase two: All participants were recruited from our community panel. In total, 40 young people participated in the study. This included a total of 15 potential students, 8 students and 17 graduates. The groups were structured as follows:

- Group 1: Potential university students who definitely want to study physics
- Group 2: Potential university students who are interested in physics and other subjects
- Group 3: University students who were interested in physics but decided not to study it
- Group 4: Graduates from traditional physics backgrounds (white, male, affluent)
- Group 5: Graduates from non-physics backgrounds.

Phase three: The sample consisted of applicants who intended to start university in 2012/13 and who considered studying physics at university. It was split into two groups:

- Accepters: Those who have applied to study physics
- Rejecters: Those who considered physics but did not apply to study it.

In total, 538 young people completed the survey, with eight participants removed from the dataset as part of our quality-assurance process. All participants were recruited from the applicant panel.

Quotas and weighting

Phase one: Data for Module 1 were weighted to reflect the proportion of males and females at each institution in the UK, and each institution was weighted to reflect its proportion of students in the UK. Data were weighted to HESA 2008/09 data. The weighting matrix for 2010/11 is available from YouthSight on request. A similar approach to weighting has been taken in previous years.

Phase two: Quotas were set to achieve the specified sample composition.

Phase three: Quotas were set to achieve 250 completed interviews with accepters and 250 completed interviews with rejecters.
Incentives

**Phase one:** All completers received £1 in Amazon vouchers.

**Phase two:** Participants were incentivised with £30 in Amazon or Bonusbond gift vouchers for taking part in the group. Bonusbond gift vouchers can be used as a cash alternative at a wide range of high-street shops.

**Phase three:** Participants were incentivised with £1 in Bonusbond gift vouchers for completing the survey.

**Questionnaire/discussion guide**

**Phase one:** All interviews were conducted online using a questionnaire developed over the past six years by YouthSight and The Knowledge Partnership. The questionnaire was piloted online to ensure that routing was correct and that questions were understood by respondents. Questionnaires took an average of 31.5 minutes to complete. In 2010/11 the sample was split into three sub-samples on a random basis to allow questioning on specific topics while maintaining an acceptable length for the questionnaire. Thus questions on these topics – employability, media sources and effect of fees on university decision – were answered by only a third of the sample (approximately 3750 students per study).

**Phase two:** The topic guide was designed by YouthSight in consultation with IOP.

**Phase three:** The questionnaire was designed by YouthSight in consultation with IOP, using insights gained from Phase 2 of this study.

**Fieldwork timing**

**Phase one:** Interviewing for the 2010/11 wave of fieldwork started on 19 November 2010 and finished on 8 February 2011. Interviewing for the 2009/10 wave of fieldwork started on 20 November 2009 and finished on 10 February 2010.

**Phase two:** The focus groups were conducted between 24 November and 2 December 2011.

**Phase three:** Survey fieldwork was conducted between 25 January and 27 February 2012.
Data processing
Data processing (DP) was carried out in-house by our team of DP and IT professionals. Data were checked for consistency using automated logic checks during collection. At the analysis stage, the data were again verified using industry-standard automated tests and by employing manual, visual and sense checks. Client deliverables were thoroughly compared to raw data toplines to ensure that they reflect the collected data.

Data analysis
**Phase one:** Customised tables were produced by YouthSight so that the data could be analysed by subject of study to allow comparisons to be made between students of physics and astronomy, competitor subject groups and the UK average. The findings in this report are based on a systematic analysis of these custom data tables, a process that involved identifying frequencies, commonalities and significant differences.

**Phase two:** The transcripts from the online groups were analysed using a classic content-analysis approach. Verbatim quotes from the groups are included to illustrate the way that young people talk about the issues involved, and counts are used to understand how frequently the issues were mentioned.

**Phase three:** YouthSight processed the data to produce a set of tables with analysis breaks by sample type (accepters, rejecters), gender, age (17 and under, 18 and over), ethnicity (white, non-white), social grade (AB, C1C2DE, other) and home region. The data tables indicate significant differences within data breaks (e.g. between male and female respondents). This report is based on a careful analysis of these data tables, combined with findings from Phase 2 of this study.
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