Computer Science:

Student Engagement & Retention

Report sponsored by the Council of Professors and Heads of Computing

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Executive Summary

The computer science subject area shows a non-completion rate in UK HEIs of 18.9% in 2012/13, the most recent figure published by the Higher Education Statistics Agency (HESA). This compares poorly with a sector-wide non-completion rate of 13.6% for the same year.

This report presents the findings of a study investigating 1st year undergraduate computing students' social and learning experiences as they impact on student engagement and retention in 5 UK universities.

A sample of 375 students from four UK HEIs covering different UK regions (England, Scotland and Wales) participated in this trial study. The engagement and retention issues identified in this report were found to be common across all institutions. For these participants, the study found:

a) Computing students expressed more satisfaction with organised courses where requirements are clearly explained by their instructors. Furthermore, they preferred expectations to be explicitly identified and instructors to support them in meeting these expectations.
b) Computing students believed that when they participated in small to medium study groups their academic experience improved.
c) Computing students valued good teaching support during their tutorial/ laboratory exercise sessions and non-academic staff were found to be providing good support.
d) Computing students expected their course to be less lecture-oriented and more tutorial/laboratory exercise oriented classes, when comparing themselves to students in other disciplines.

The engagement and retention implications highlighted within this report include:

- The report identifies study time (supervised and unsupervised hours) as a key factor affecting students' feelings of low student engagement and some students expressed a desire for additional teaching hours.
- Enabling students to make informed choices reduces the likelihood of drop-out or course changes during their academic studies (BIS, 2011; HEPI, 2013) (see also Section 9.2). Focus group responses found that students usually apply for courses based on their employment prospects and despite the advent of the Key Information Set (KIS) data, students had little awareness or understanding of this information source.

The spread and identities of the universities involved do not represent all types of UK HEI, instead the approach was an exploration of areas for further consideration.

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1. Introduction and Background

1.1 Challenges

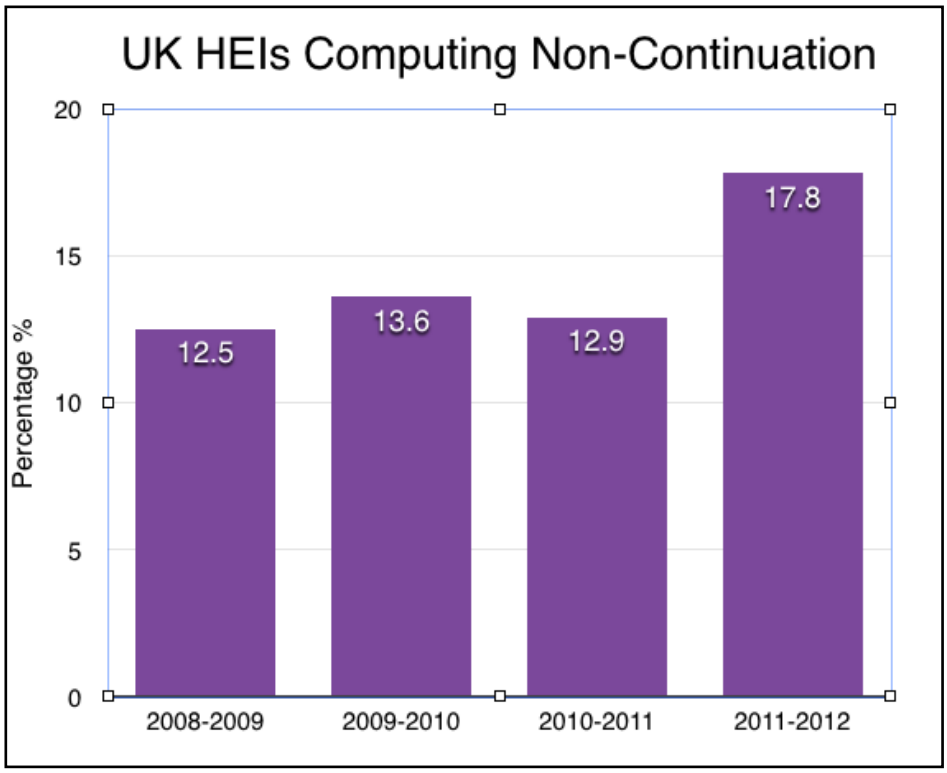
The landscape of UK Higher Education (HE) has become increasingly competitive in recent years, raising difficult questions for students and the sector alike. In particular, from the student's perspective, a rise in tuition fees combined with a challenging economic outlook both nationally and internationally means that there has never been greater pressure for students to make the right choice of course and institution. From an institutional perspective, UK Higher Education Institutions (HEIs) face the challenge of understanding and meeting the expectations of more demanding students without additional funds (HEPI, 2013). In this new environment, UK HEIs are therefore tasked with maintaining, and indeed improving, their academic experience and student engagement at the increasingly high levels demanded by students.

1.2 Recent Statistics

Official figures for 2013 show that more than 27,000 students (one in fourteen) leave HE after less than 12 months (HESA, 2014a), with a further 37,800 students (one in ten) identified at being at risk of failing to complete their course (HESA, 2014a). Data from the Higher Education Statistics Agency (HESA) showed an improvement in the overall non-continuation rate for the academic year 2012-2013 compared to the previous year (HESA, 2014a), with an extra 4,500 students retained. The method followed by HESA is based on tracking students from the year they enter a HE provider to the following year (for full-time students), or the following two years (for part-time students) and provides information about where the students are in that year; continuing at the same HE provider (either on the same course or elsewhere in the HE provider); transferring to another HE provider; or absent from higher education completely (HESA, 2014d). In contrast Figure 1 shows the non-continuation rate for the computing sector for all UK domiciled entrants to full-time undergraduate courses over a four year period from 2008-2012. The non-continuation rate for UK HEI computing departments in 2011/12 was 17.8% (HESA, 2014a), a significant increase on the previous three years and counter to a general

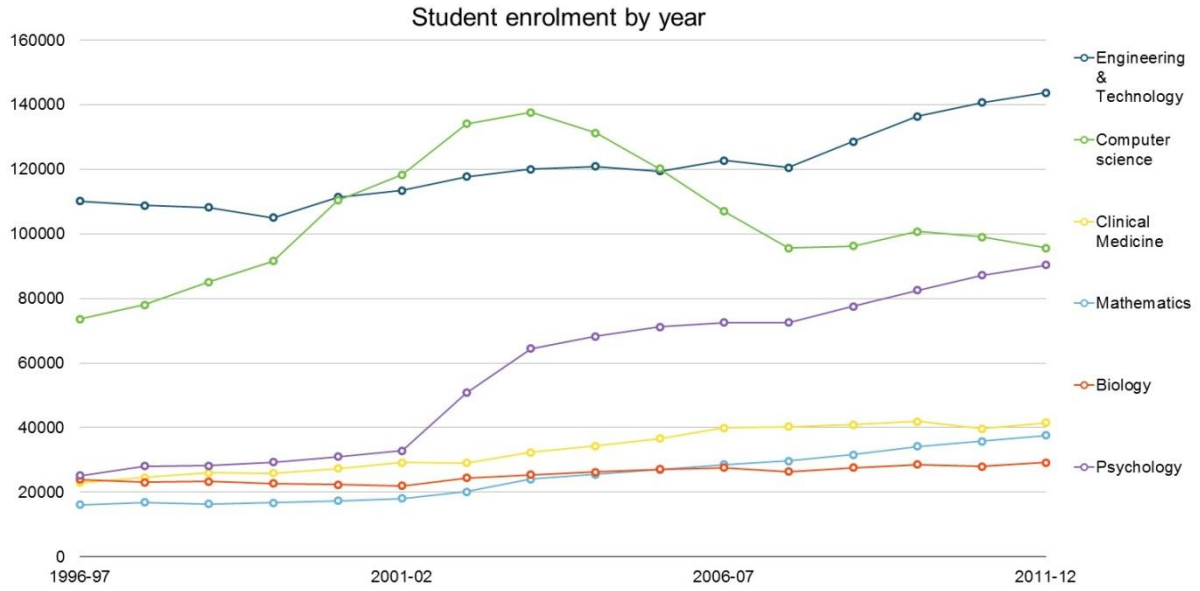
reduction in non-continuation within higher education. The recently published data for 2012-2013 show the non-continuation rate at 18.9%.

Figure 1: UK HEIs computing non-continuation rate (HESA, 2014b)



Alongside a concerning non-continuation rate, computing courses have shown only modest average growth in enrolments over the last two decades, with a 30 % increase from 1996-7 to 2011-12, compared to an average increase of 59 % in the other subjects shown in Figure 2 (Matthews, 2014). There was a significant increase in enrolment numbers in the early years of this century, mirroring a large increase in computing-related jobs within the UK economy (Lowenstein, 2004; Anderson et al, 2010), but the overall trend has led to only a modest increase in enrolments.

Figure 2: Student enrolment by year (THE, 2014)



1.3 Study Approach

For almost six decades, higher education researchers have been investigating the phenomena of undergraduate student retention, persistence and academic success. The first significant studies of student retention by Tinto (1975) and Astin (1975) looked at student drop-out characteristics. Tinto (1975) noted that the highest proportion of students that leave an institution do so during their first year of university (Tinto, 1975), a pattern that persists to this day (Tinto, 2012). In addition, Tinto (1993) subsequently discussed how the first year of study helps students connect to their campus as well as influencing subsequent student achievement and graduation rates. A significant factor in building a student's connection to their campus, and their identification with their studies, was found to be through engagement in learning communities (social and learning experiences) (Tinto, 1975).

A learning community is described by Vincent Tinto as a "co-registration or block scheduling that enables students to take courses together" (Tinto, 1998). A generative definition of learning communities is offered by Gabelnick et al.:

"*Any one of a variety of curricular structures that link together several existing courses (or actually re-structure the material entirely) so that students have opportunities for deeper understanding and integration of the material they are learning, and more interaction with one another and their teachers as fellow participants in the learning enterprise*" (Gabelnick et al., 1990, p. 19).

This study investigates the 1st year computing undergraduate students' social and learning experiences through the learning community lens. Supporting the development of learning communities can promote an environment which facilitates good pedagogic practice, as learning is enhanced by social interaction (Bruner, 1960; Smith, 2003; Daniels, 2005). Learning socially and actively fosters the development and enhancement of learning communities, as these develop through learning activities; including individual and group research, discussion, and collaborative problem solving (Bielacyzc and Collins, 1999). Fostering learning communities has been shown to increase student learning and retention (Shapiro & Levine, 1999).

It has long been argued that the first year university experience has a critical influence on a student's intention to complete their undergraduate studies (Upcraft et al., 1989; Upcraft et al., 2004; Kuh et al., 2005). Most of the recent research in this area builds on Tinto's and Astin's work (Barefoot, et al, 2005; Nicol, 2008; Whittaker, 2008), with Tinto's model for early departure of students from HE (Tinto, 1993) a key publication in this area, and widely cited in more recent related work (Lenning & Ebbers, 1999, p. 4; Heaton-Shrestha et al., 2009; Braxton et al., 2011; Thomas, 2012, 2013). Tinto has shown through his research over the last forty years that students who become integrated to the campus academically and socially, both in the classroom and as part of study programs, are more likely to persist through to graduation than those who fail to become fully integrated into the institution (Tinto, 1993).

1.4 Research Tools

Student and academic engagement form the basis of the survey framework. The National Survey of Student Engagement (NSSE) was chosen as the most appropriate tool as it explores both student and academic engagement. The US NSSE is a long-established model, from which, for instance, the Australian AUSSE survey was derived (Gibbs, 2014; Buckley, 2014). It includes broader categories of questions than the UK National Student Survey, focussing on more factors related to higher education experiences (NSSE, 2014a; NSSE, 2014b). In addition to the survey, focus groups enabled a more in-depth investigation of students' social and learning experiences (academic and non-academic) through learning communities. A discussion of the research tools used is presented in Section 3.

2. Importance of the study

The UK government believes that it will need a future generation that is skilled and passionate about computing (HMSO, 2012). If the UK wishes to remain a world leader in research and technology (HMSO, 2012), current retention challenges facing computing departments at UK HEIs need to be addressed; inspiring more students to study computing and improving skill levels to produce highly employable computing graduates.

A breadth of academic research on student retention during the last forty years (briefly outlined in Section 1.3) has shown a relationship between student retention, student engagement and the development of social and learning experiences (through learning communities) within higher education. Students' participation in social and learning experiences (through learning communities) is also correlated with student success, especially for first year students (Tinto, 1994; Whittaker, 2008).

Given the retention challenges facing computing departments (HESA, 2014a), it is important to understand the students' perspective of their studies, the experiences computing students have whilst engaging in their learning and whether the social and learning experiences computing students currently experience at UK HEIs are adequate to meet their academic and non-academic needs. This report therefore explores a range of questions within the context of the institutions studied. Are current learning communities efficient and effective? Do students engage academically and socially?

By viewing the student social and learning experiences through the learning community lens (Harvey & Drew, 2006; Yorke & Longden, 2008; Knox & Wipper, 2008), this report identifies factors influencing students' perspectives on their studies. Consideration of these may help improve the retention of 1st year undergraduate computing students in UK HEIs.

3. Research Methods

3.1 Quantitative study: NSSE Survey

Student engagement has been the focus of a substantial amount of research in the last few years, particularly in the USA (Pike, 2011; Bureau, et al., 2011, McCormick, et al., 2013). In the past ten years student engagement surveys have also become increasingly common, especially in the UK (Mann, 2001; Buckley, 2014) and Australia (Krause, et al., 2005; UWA, 2005; Krause & Coates, 2008). The National Survey of Student Engagement (NSSE) is a particularly well-respected engagement survey, which has become widely integrated into higher education practices and policies in the United States, Australia, New Zealand, South Africa, China and Ireland (Gibbs, 2014; Buckley, 2014). Approximately 2.1 million students from different universities were invited to complete the NSSE in 2014 (NSSE, 2014).

Although it has been built on decades of research (Astin, 1993; Pace, 1979; Chickering & Gamson, 1987), the NSSE framework was the first to be developed explicitly as a model of university student engagement. The NSSE embodies two crucial features of study quality. Firstly, it identifies the amount of effort and time students put into their studies and educational activities. Secondly, it enables institutions to review how to support students and hence improve student engagement with their learning activities (NSSE, 2005; NSSE, 2010). The NSSE is a self-reporting instrument of 70 items (Popkess & McDaniel, 2011). For the purposes of providing aggregate reports to institutions, the framework divides student engagement into five dimensions:

- Level of academic challenge
- Active and collaborative learning
- Student-faculty interaction
- Enriching educational experiences
- Supportive campus environment

3.2.1 NSSE rationale and aim

The primary focus of the NSSE survey in this study is to help identify some of the key factors that may lead to low student retention in UK 1st year undergraduate computing students. The NSSE assesses the extent to which students engage in educational practices associated with high levels of development and learning, through using tested measures which map to existing retention studies (NSSE, 2014a). The questionnaire collects information, based on the five dimensions listed in the section above, using five different categories:

- Background and demographic information,
- Estimates of educational and personal growth since starting university,
- Institutional requirements and the challenging nature of coursework,
- Participation in educationally purposeful activities,
- Perceptions of the institution's environment (NSSE, 2014a).

In each category the NSSE survey can be modified to include topical modules depending on the aims of the study. These topical modules are short sets of additional questions such as academic advising, civic engagement, transferable skills development, experiences with diverse perspectives, learning with technology and experiences with writing (NSSE, 2014b). The questionnaire used in this study is shown in Appendix 1 (see separately attached document). It is structured using the NSSE framework and includes its instruments and topical modules. Appendix 2 lists these instruments**,** including the NSSE topical modules, together with references showing previous publications using similar NSSE surveys for investigation in related research areas (see separately attached document).

Understanding the 1st year experience is critically important in order to retain students (Krause, 2005) and to set up the foundations for academic success. The study therefore asked UK HEIs to select campus-based students who were enrolled in 1st year undergraduate computing programmes. The first data collection took place in October 2013, with the second data collection taking place in the early 2014. The study, which was conducted in four UK HEIs, involved students completing the NSSE survey, followed by student focus group discussions.

3.2.2 Survey methodology

The NSSE survey was emailed to contact points at each institution and forwarded to their 1st year computing undergraduate students. The survey was designed to take no more than 20 minutes to complete. Most of the questions required a tick in a box with a few requiring responses to open-ended questions. The engagement survey was designed to assess 1st year computing students' opinions about different aspects of their experience at University, investigating how they find their social and learning experiences and if they had any concerns about continuing their studies.

3.3 Qualitative study: Focus Groups

Supporting the quantitative data from the study, the analysis also used a qualitative research method known as the "unfolding matrix" (Padilla, 1991, 1994, 1999-2000; Padilla, Treviño, Gonzalez &Treviño, 1996, 1997). The "unfolding matrix" provides a structured approach for capturing data collected via interviews (in this case focus groups) (see Appendix 3 & Appendix 4 on a separately attached document). The process involves participants in each focus group completing the matrix, with participants able to comment on responses already recorded using the matrix. The outcome of this process is a completed matrix with raw data. This data can then be analysed, coded, theme-grouped and developed into assertions (the completed matrix is shown in Appendix 3 on a separately attached document).

4. Ethical Issues

For both survey and focus groups all answers were treated with complete confidentiality and all data were anonymised before analysis. Student identifiers were used so that responses could be linked to the information students provided when they enrolled. Once the identifiers were used for this purpose they were removed from the data set before analysis. In addition to providing consent before undertaking the study, students also had the opportunity to have their data removed up to two weeks after completing the survey. Any responses which mention specific individuals, modules or courses were anonymised, and for the focus groups the participants completed a separate consent form.

5. Research Methods Conclusion

The survey sample was 375 full-time computing undergraduate students in their first year at UK HEIs. In addition, focus groups took place at each of the computing departments which took part in the survey. Specifically, 76 students who had already completed the survey formed 8 focus groups, with 8 to 10 participants in each group. The survey and focus groups took place between the 27 February and 20 March 2014. Data was analysed at the computing subject level. Targets for comparison were also supplied by the Higher Education Statistics Agency (HESA) and Higher Education Policy Institute (HEPI). In order to ensure accuracy in the results, reporting rules were established. For analysis purposes 10 or more responses in a particular computing area within an institution was deemed sufficient in order for the results to be presented. The data consists of survey responses and corresponding focus group data from students studying computing courses at the four participating institutions. The sample is not demographically or sectorally representative i.e. statistically weighted, and the findings are therefore only indicative of potential retention factors.

6. Presentation of Findings

Sections 7.1 to 7.2 present the findings from NSSE and focus group studies conducted at computing departments of four UK HEIs. The findings are followed by a discussion about implications which are outlined in Section 8 and 9 respectively. The report concludes with the study's limitations (Section 10) and proposals for further research (Section 11).

The remainder of the report is structured into the following sections:

- **Findings: NSSE and focus group analysis.** The findings section is divided into two main parts. Part one (Section 7.1) is about how students perceive their academic experience and part two (Section 7.2) is about what students think about their academic experience.
- **Synopsis and recommendations.** This section summarises the identified issues for 1st year undergraduate computing students.
- **Retention implications.** This section discusses the challenges identified from the study for the computing sector within UK HEIs.
- **Limitations.** Limitations of the current study are presented.
- **Further research.** Recommendations for further research are discussed.

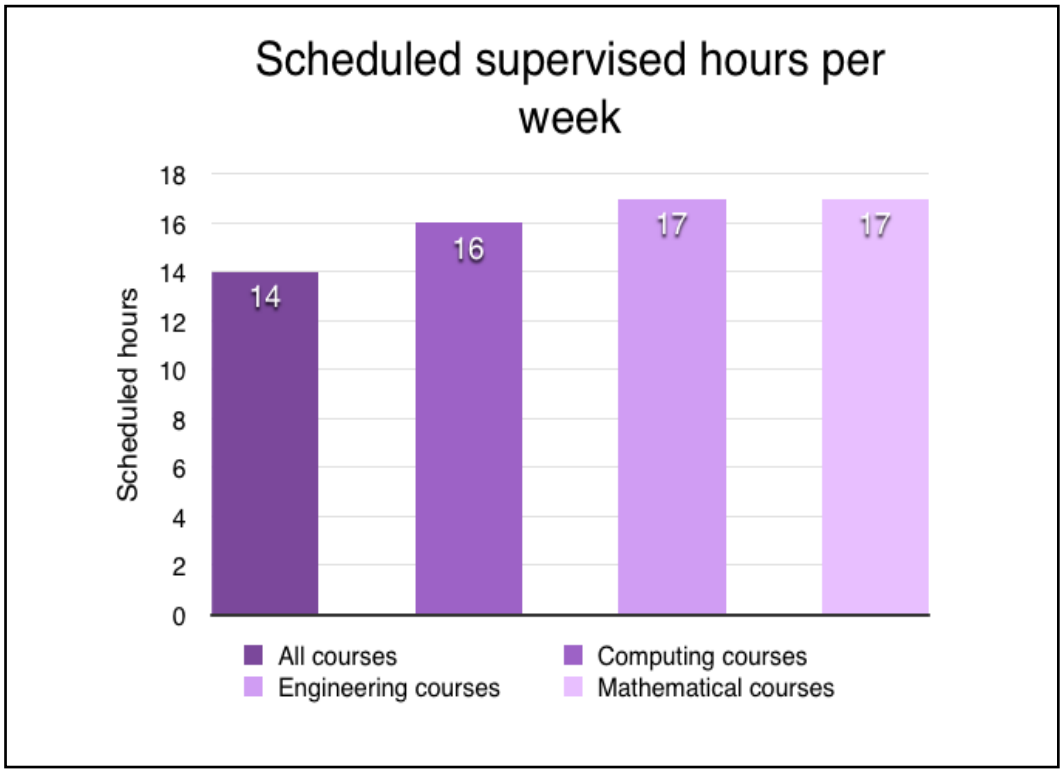
7. Findings

7.1 How students perceive their academic experience

7.1.1 Supervised contact hours

Figure 3 presents the average supervised hours (comprised of lectures, tutorials and supervised laboratories) per week for 1st year students for UK computing courses and compares this to the average for all courses, engineering and mathematics courses. The average for all courses is 14 hours per week, whilst for engineering, mathematics, and computing it is higher at 16, 17 and 17 hours per week respectively (HEPI, 2013). This is to be expected as courses with large practical elements have more contact hours than courses with more theoretical content and those involving greater levels of independent research and reading.

Figure 3: Scheduled supervised hours per week across the HE sector (HEPI, 2013)



Whilst on average computing courses have more supervised hours to support more practical content, significant variations were highlighted when reviewing the supervised study time at the institutions considered within this study. The range of mean scheduled contact hours for computing courses at the four participating institutions had a median value of 16 hours, but varied from 13 to 20 hours. An anonymised breakdown for each participating institution is presented in Table 1, which shows the institution with the lowest mean of supervised hours per week as well as the institution with the highest mean. Differences in the amount of supervised hours between institutions' computing courses are hard to explain, with some institutions providing a much higher amount of supervised hours compared to others. A more in-depth analysis is presented in section 7.2.3.

Table 1: Examples of mix of supervised and unsupervised study hours per week (unweighted)

	Examples of mix of supervised and unsupervised study hours		
	Mean supervised	**Mean Unsupervised**	
University 1	13 hours	20 hours	Low supervised, High unsupervised
University 2	20 hours	19 hours	High supervised, High unsupervised
University 3	13 hours	11 hours	Low supervised, Low unsupervised
University 4	18 hours	13 hours	High supervised, Low unsupervised

7.1.2 Different contact types

Gibbs (2010) states that the amount of supervised hours is less important than the quality of the contact. Gibbs (2012) also highlights that there are negative educational outcomes associated with large teaching groups. Other factors, which also influence educational outcomes, include the feedback given to students and their social and learning experiences (Gibbs, 2012). These factors are discussed in the following sections.

7.1.3 Small size classes

In the institutions visited classes typically included single academics sometimes with teaching assistants as well. On average computing students attended 4 to 5 hours per week in medium-sized groups (classes of 6 to 20 students) for tutorial/laboratory exercise classes, and 3 to 4 hours per week in large-sized groups (classes of 21 to 50 students) mainly for lectures and sometimes for tutorial/laboratory exercise classes. There are considerable variations in practice amongst the various computing departments studied. This is discussed further in Sections 7.2.3 and 7.2.4.

The findings from the focus groups show that small group teaching (tutorial/laboratory exercise classes of 1 to 5 students led by academic and/or teaching assistants) is preferred by students. 60% of students who had experience of drop-in sessions and/or small classes (tutorial/laboratory exercise classes of 1 to 5 students) stated that they would prefer learning in small groups as this aids them in gaining more knowledge and being more effective with their studies. By comparison 20% of students stated that they prefer large group teaching (classes of more than 50 students) and 20% preferred medium group teaching (classes of 6 to 20 students).

Students were asked if classes were led by an academic member of staff or a non-academic member of staff, for instance a postgraduate research student. All students stated that academic members of staff were more likely to lead large group practical sessions and lectures. Over 95% of the classes with more than 50 students were led by an academic member of staff compared to 80% of the classes with 1 to

5 students which were led by a non-academic member of staff. Generally, non-academic members of staff were used to lead small teaching groups, such as mathematics and programming drop-in sessions. Such sessions led by research students were common across the four institutions surveyed. Furthermore, students during focus group interviews stated that they perceived research students as teaching assistants to be more approachable and felt more comfortable when the small teaching groups were led by them. In addition, students mentioned during the focus groups that in those cases their academic engagement was higher and they tended to learn more. This agrees with Gibbs (2012) whose work indicates that small size classes increase students' sense of belonging. This issue is discussed further in Section 7.2.

7.1.4 Feedback

Gibbs (2012) states that "the amounts of feedback students receive and the nature of this feedback has a marked effect on student outcomes". In terms of feedback for tutorial/laboratory exercises the majority of students were satisfied with receiving verbal feedback. For coursework which was handed in, the most common way for students to receive feedback was through written comments related to the assessment criteria and a grade (by e-mail and/or printed). This was reported by 70% of the 1st year computing students, 20% of students stated they received verbal (in person) feedback for their coursework and 10% reported receiving no feedback. Students preferred to receive written feedback on their coursework and this is discussed further in Section 7.2.8. Finally, in the institutions visited, 75% of the computing students mentioned that they mainly receive feedback on physical copies of their work. It is interesting to note that whilst the extensive use of e-mail is perhaps to be expected within computing departments where students are traditionally engaged with technology use, feedback to students is generally provided via physical copies of their work.

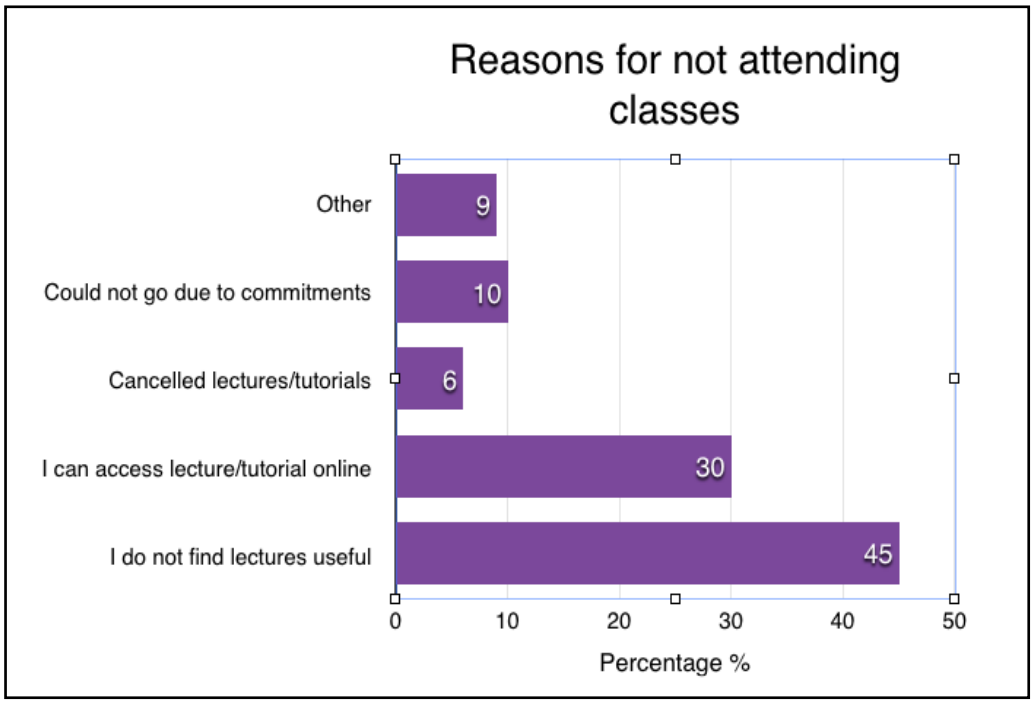
7.2 Student Academic Experience

The second part of the findings section is about what students think about their academic experience. Specifically, the following sections discuss class attendance and students' commitment to unsupervised study.

7.2.1 Attendance

A third of students stated that they had missed, on average, an hour per week of their taught sessions. This reduces the actual average of supervised hours for computing students from 16 to 15 hours per week. When the students were asked to explain why they stopped or rarely attend certain classes (comprised of lectures, tutorials and supervised laboratories) their most common answer was related to how useful they found the previous sessions they had attended. Specifically, 45% of the students reported that they did not find the lectures useful and 30% said that they felt no need to attend the lectures as they can access all notes online. Other reasons included work commitments (10%), cancelled lectures/tutorials (6%,) and a variety of other reasons (9%) including personal reasons, health reasons and language comprehension difficulties (see Figure 4).

Figure 4: Reasons for not attending classes (weighted)



7.2.2 Unsupervised hours

According to the Higher Education Policy Institute (HEPI, 2013) the average of unsupervised hours in all courses is 16 hours per week. In the current study the average for computing courses was 15 hours per week.

Whilst the average figure is 15 hours per week, there is some variation in unsupervised study behaviour amongst different students. Women are under-represented in computing departments, and across the wider STEM subjects within the HE sector (HESA, 2012). Interest in computing courses, stereotypes, personality, values, interpersonal orientation and computer self-efficacy are all areas where differences between men and women have been identified (Botcherby & Buncker, 2012). These areas, as they relate to computing course studies, are a potentially interesting area of further research, in particular in relation to attitudes and approaches to study. Within the current study, a comparison was made between male and female students in terms of unsupervised study time, and within the sample, female students on average spent two hours per week more studying than

male students. Another potential variation in unsupervised study relates to student age where, in this study, younger students tended to engage more in study groups with classmates than mature students who spent more hours studying individually (Woodfield, 2011; HESA, 2014). Finally students in this study who had part-time employment commitments were no less committed to either unsupervised study hours or class attendance, reflecting the results of other UK research in this area (Thomas, 2002; Robotham, 2012). Further information is provided in Appendix 3 on a separately attached document.

7.2.3 Total supervised and unsupervised study hours

By considering the number of supervised study hours alongside the unsupervised study hours, a view of the relationship between the two can be gained. Students who attend 0 – 10 supervised teaching hours per week on average spend 15 hours on unsupervised study. Students attending 11-15 supervised teaching hours tend to spend slightly fewer hours on unsupervised study (14 hours) whilst students with supervised teaching hours above 15 hours per week, either 16 – 20 hours per week, or more than 20 hours, study more outside of taught sessions (16 and 18 hours respectively). Of the students studying more than 20 hours, the majority (70% of this group) were female, and mature students (40% of this group) were also disproportionately represented.

These averages highlight a variation at each of the participating institutions in terms of supervised teaching and unsupervised study hours. These averages also vary significantly from sector-wide expectations of the amount of time students should be studying (HESA, 2014a; HESA, 2014b). This variation by institution is summarised in Table 1 (see section 7.1.1). Table 1 provides examples for four institutions illustrating their different combinations of unsupervised and supervised study hours. The issues related to this variation are discussed further in Section 7.2.6.

Approximately 10% of the total sample surveyed expressed their desire to drop out of university. Those dropping out are harder to reach and the current study was focused therefore on those that have expressed a desire to dropout. These students' views need to be understood in order to improve their experience and reduce the risk of further drop out.

As the sample did not include students who were already disengaging, the level of desire to dropout is likely to be higher than 10%. Of those within the sample who expressed a desire to dropout, all felt confident about their academic skills, and the majority stated that they felt their course was challenging enough for them (70% of the 10%) and they reported attending the majority of their supervised study hours (80% of the 10%). When this was explored further within the focus groups, students who expressed a desire to dropout said that they had decided to continue with their studies because they felt this increased the likelihood of developing a future career and that having invested a time and financial commitment they wished to persist with their studies.

7.2.4 Student workload

This study indicates that the four institutions' averaged total workload of 1st year undergraduate computing students is 31 hours per week (30 when factoring in the hour of scheduled learning missed out by student each week on average, see Section 7.2.1). The averaged workload for 1st year computing students is almost the same as the overall 1st year student average of all STEM courses, which is approximately 32 hours per week (HEPI, 2013).

7.2.5 Academic Experience

In general, according to the NSSE survey, computing students were satisfied by the overall quality of their course, both in terms of what they receive and contribute to it. Specifically, 85% mentioned that it is good. A minority expressed dissatisfaction with their academic experience. When the students were asked if their academic experiences met their expectations 30% said they had exceeded them, 60% said they had been neither worse nor better and 10% said they were worse than

expected. Furthermore, 20% stated that they might have changed course if they knew what they did now about their academic experience.

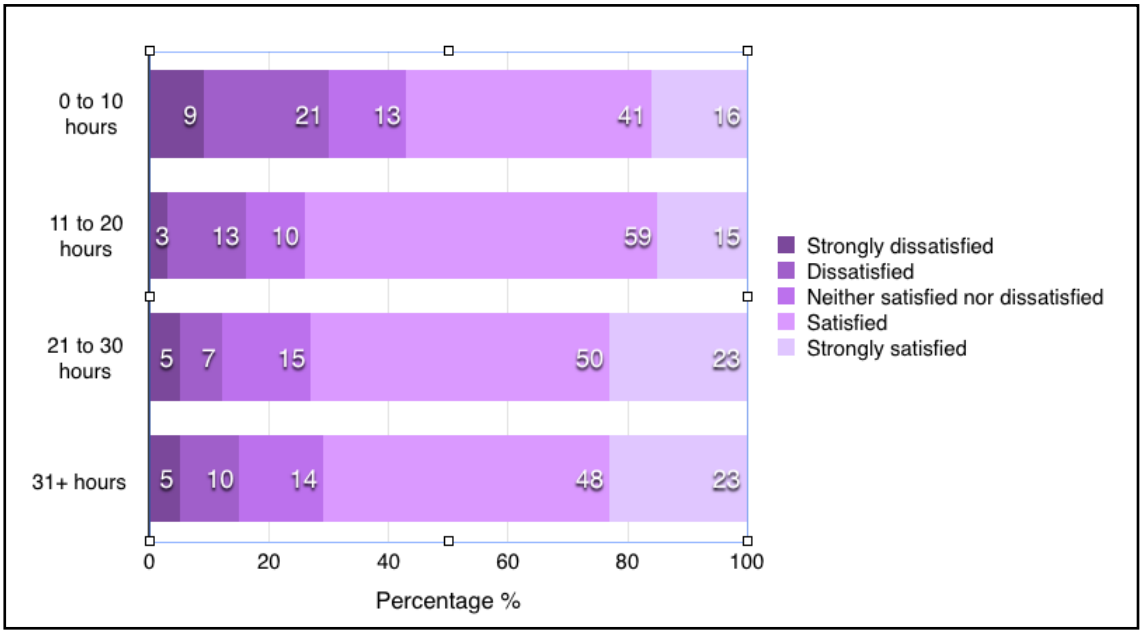
The main reasons for dissatisfaction amongst all students in the sample were:

- 34% of the dissatisfied students thought that their course was not well organised
- 32% stated that teaching quality was low
- 30% that they expected better support from tutors
- 26% of the dissatisfied students felt that feedback was poor
- 25% that large classes were not effective
- 15% stated that the course was not challenging enough

7.2.6 Scheduled supervised hours

Students who responded through focus groups stated that one of the main reasons they felt their course was not as challenging as they expected was because they had less supervised hours than they had expected. In other words, they expressed their desire for more tutorial/ laboratory sessions that could offer more practical hours with more work to do while on campus. Figure 5 shows that between 20% and 30% of students in the survey were either dissatisfied or strongly dissatisfied with the amount of supervised hours they received, and that for students who received 0 to 10 supervised hours per week only 57% were either satisfied or strongly satisfied with the supervised hours they received, whilst 73% of students receiving 21 to 30 hours per week were either satisfied or strongly satisfied with the supervised hours they received. Within the focus group discussions students also linked supervised hours with 'value for money', with more satisfied students those who receive a high number of scheduled supervised hours per week.

Figure 5: Proportion of computing students satisfied with the amount of supervised teaching hours they received per week



A logistic regression analysis was conducted in order to test the independent association of factors with the likelihood of being satisfied with 0 to 10 supervised hours per week. The analysis of the survey data identified the following factors as being the most important regarding student satisfaction with the scheduled hours they received.

- If students are satisfied with the teaching quality
- If students have developed their relationships with the academic staff (lecturers, tutors)
- If students are satisfied with the use of university facilities

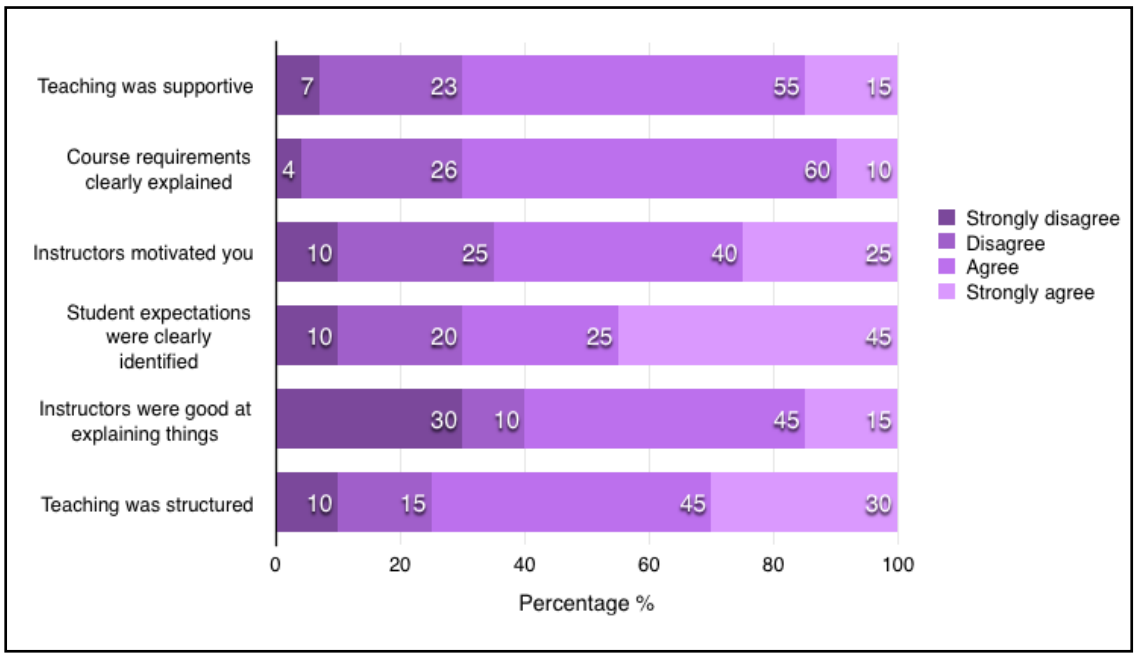
These factors were also checked against students' comments (see Appendix 3 on a separately attached document) from the focus group data. From that analysis one further factor was identified.

- If students have a clear understanding of the course aims/objectives.

7.2.7 Teaching Quality

Overall, students were satisfied with the teaching quality they received. As shown in Figure 6 most of the students characterised the teaching staff as supportive (70%). Furthermore, 70% agreed that course requirements were clearly explained.

Figure 6: Student satisfaction of teaching quality



However 35% of the students indicated that they were not motivated by their instructors and 40% of respondents stated that instructors explained things poorly. In addition, 25% stated that the teaching methods were not structured well. A very similar percentage viewed their bad course experience as linked to a poorly organised course (see section 7.2.5). The NSSE encourages students to connect their study engagement to their evaluation of their studies, and therefore provides a potentially more rounded evaluation than the National Student Survey for example. Nonetheless, in responding to the survey questions, students may not explicitly consider their contributions to their studies when evaluating their experiences, and therefore the responses should be seen both as indicative and potentially influenced by, for instance, a broad range of personal, social and demographic factors. A more comprehensive quantitative study is therefore required to draw firm conclusions regarding teaching quality.

Similar concerns regarding their studies were raised by students during the focus group discussions. Students commented that some lectures were not useful partly because they could access the material online outside of the lecture or because there was no additional information provided by the lecturer in the lecture to support the lecture slides. Students said that they wanted more interactive sessions, shorter lectures and to spend more hours undertaking activities where they could have a more personal contact with the instructor. Students perceived that their subject required more practical exercises and tutor supported activities than some other disciplines. This agrees with Gibbs (2010, 2014) whose work addresses a connection between teaching quality (as well as instructors' roles and functions) and retention.

7.2.8 Feedback

This study identifies that feedback remains an issue for computing courses. Overall, 60% of the students are satisfied with the feedback given to them, but 40% disagreed that teaching staff had given them prompt feedback. Half of those that disagreed said that they get feedback but with poor comments, whilst the other half would like to have received further comments or discussion from their instructors, not just feedback repeating the assessment criteria. This mirrors national dissatisfaction with assessment and feedback within computing courses as expressed through the NSS. In particular computing students score the 15th lowest out of the 20 subject areas of study in the UK HEIs for their views of assessment and feedback in their courses (HEFCE, 2013b).

7.2.9 Facilities usage

In general, there was high student satisfaction (90%) with access to university facilities. Access to facilities was seen as important by students in terms of supporting their unsupervised study, though the level of satisfaction with facilities did not affect the number of supervised or unsupervised study hours undertaken.

7.2.10 Course structure

One of the main reasons that students gave for their dissatisfaction was poorly organised courses (34%). Exploring this issue further with focus group participants highlighted an interesting finding that students responding to this question, for example within the NSS survey, associated poor course organisation with poorly explained information regarding their studies.

8. Findings Synopsis

In the current study the sample is not statistically weighted, as such it is not demographically or sectorally representative. The findings are therefore only indicative of possible engagement factors. In addition, the spread and identities of the universities involved do not represent all types of UK HEIs and therefore all findings are provisional. The study does not provide robust statistical conclusions; instead its approach and areas of exploration highlight areas for further investigation.

Whilst the students' perspective provides a valuable insight into levels of engagement as they affect the students themselves using this approach does have limitations in terms of the accuracy of the data that can be collected. Students may for example view issues in terms of the actions others may take to resolve a situation rather than how they may do things differently, and so the reported areas represent only the students' expressions of the external factors influencing their view of their studies.

Having stated these caveats, and before highlighting some key areas for further investigation, it is worth emphasising that most students replying to the survey and focus groups were happy with their university studies. The messages emerging from the NSSE survey results and follow-up focus groups were:

1. Computing students expressed more satisfaction with organised courses where requirements are clearly explained by their instructors. Furthermore, they prefer expectations to be explicitly identified and instructors to support them in meeting these expectations.
2. Computing students believe that when they participate in small to medium study groups their academic experience is improved.
3. Computing students value good teaching support during their tutorial/ laboratory exercise sessions and non-academic staff were found to be providing good support.
4. Computing students expect their course to be less lecture-oriented and more tutorial/laboratory exercise oriented classes, when comparing themselves to students in other disciplines.

Students' expressed a desire for more supervised teaching hours (see section 7.2.6) and felt that the amount of supervised study hours linked to their sense of engagement. As such, increasing supervised study hours may lead to students feeling more satisfied. Table 2 summarizes all the negative factors, identified from the NSSE survey and focus group discussions, which influence students' views of their academic experience. Dark blue indicates the most significant factors (high and medium significance) and light blue highlights the least significant (low and very low significance).

Table 2: Influence factors

Possible Influences:	Computing courses (N of Responses=375)	Significance:	
Realised I had chosen the wrong study area	20		
Course not relevant to my interests	20		
Course difficulty	13		
Low engagement with course	13		
Not satisfied with teaching style provided	21		
Low teaching quality from instructors	21		
Non-supportive academic staff (i.e. Contact)	25		
Feedback: delayed and low quality	25		
Course structure	15		
Class size	34		
Satisfaction of computing facilities (equipment)	25		
Social engagement (i.e. Activities, societies, accomodation, sports activities)	7		
Supervised/unsupervised hours ratio	34		
Lack of commitment to my studies	8		
Low support from other students	13		
Low support from teaching staff	33		
Not relevant study skills	7		Very low
Non-realistic course timetable (not to my needs)	7		Low
Overall teaching quality	34		Medium
N of Responses	375		High

Computing departments may not be providing teaching experiences that best meet the needs of all their students. Specifically, these participants:

1. Expressed more satisfaction with well organised courses with requirements clearly explained by their instructors. Furthermore, they preferred expectations to be explicitly identified and instructors to be supportive (**see sections 7.1.4, 7.2.1, 7.2.5, 7.2.6, 7.2.8, 7.2.9 & 7.2.10**).
2. Believed that when they participated in small to medium study groups their academic experience improved (**see sections 7.1.3, 7.2.5 & 7.2.7**).
3. Valued good teaching support during their tutorial/laboratory exercise sessions (**see sections 7.1.4, 7.2.5 & 7.2.6**).
4. Expected their course to be less lecture-oriented and more tutorial/ laboratory exercise oriented classes, when comparing themselves to students in other disciplines (**see sections 7.2.1, 7.2.7 & 7.2.10**).

9. Engagement and Retention Implications

The current section provides an analysis of the student engagement and retention implications arising from the findings outlined in this report.

9.1 Study time variability and standardisation

According to the survey analysis the average total workload for computing students is 31 hours per week. A quarter of full-time students had an average workload of less than 25 hours per week. In addition, from the focus group data analysis, students from the two institutions with low supervised study hours (see Table 1, section 7.1.1) identified issues such as; their courses not being challenging enough, significant workload variation between term 1 and term 2, or that they had less work to do than they expected. However, only a minority of students wanted a more challenging course with extra work. Nevertheless, this is an area where further research could be undertaken by individual institutions. The NSSE could provide a method for institutions to identify their students' overall workload and to engage in a dialogue with them with a view to identifying potential changes to their course delivery. HEFCE's recent consultation on the National Student Survey (HEFCE, 2011) specifically involves discussion of the benefits of engagement-based surveys.

Students reporting low unsupervised study hours were more likely to have considered dropping out. An implementation of effective monitoring of study patterns could be considered by institutions in order to support interventions designed to improve student retention, for instance through student consent for learning analytics data collection.

9.2 Improving student guidance and information provision

A third of students in the sample stated that if they had known more about their academic experience before enrolment, they would have made a different course choice. Students feel it is very important that they can have the opportunity to compare courses based on realistic information before making their final course choice (BIS, 2011). In 2012, Higher Education Funding Council for England (HEFCE) decided to make available standardised information about undergraduate courses (HEFCE, 2013). The official website to search for such information is Unistats (HEFCE, 2013; Unistats, 2014). Specifically, the Key Information Set (KIS) is a comparable set of standardised information about UK undergraduate courses (HEFCE, 2013). KIS has been introduced in response to the reforms outlined in the government white paper 'Students at the Heart of the System' (BIS, 2011). The aim of KIS is to provide the information prospective students need in order to make informed choices about higher education (Unistats, 2014). KIS draws data from the National Student Survey (NSS) and the Destination of Leavers from Higher Education (DLHE) which surveys students who gained a qualification from a university or college, six months after they left (HEFCE, 2014b; HESA, 2014c, Unistats, 2014). The introduction of KIS was intended to help students compare courses based on key pieces of information, supporting students to make informed choices. However, the information in KIS about student experience is limited (Unistats, 2014). KIS only relates academic experience to students' supervised study hours and placements, and does not include information on total workload and particular course delivery methods for example. Students, though, can access student satisfaction scores from National Student Survey (NSS) but still they do not have the opportunity to compare differences in academic experience. Again this indicates an area where further research could be undertaken. Apart from information provision, guidance and advice is also required to help students to make

better decisions. The UK higher education bodies are currently undertaking a review of the provision of information within higher education (HEFCE, 2014). Part of this review, which is going to conclude in 2015, involves KIS.

10. Limitations

The data analysis is limited by the size of the sample, with indicative findings presented in this report. In addition, only students that have been retained have been sampled. Whilst the results of this study cannot be generalised as they are focused only on the 1st year undergraduate computing students at the selected institutions, the consistency of issues between institutions increases confidence in the commonality of issues raised, and suggests further research with a larger sample across UK institutions would have significant merit. A wider use of NSSE surveys within UK HEIs would facilitate richer data collection and increased survey response rates (Gibbs, 2014). It could also help with understanding better how student behaviour and choices impact on students' levels of engagement.

11. Further Research

Many universities use exit interviews to establish reasons behind students dropping out, however these would normally only capture students who withdraw officially. Some of the factors behind students requesting formal withdrawal could be explored through conducting and analysing exit interviews held directly with students or through a survey of programme leaders charged with conducting the exit interviews.

Student profiles could be considered, for example, membership of a low-participation group. A study of different choice points during the student journey could be undertaken. Examples of such choice points are: whether a student was accepted via the clearing process, whether they had initially chosen to study a different subject, or had chosen a place at a significantly different geographical location.

Finally, a study could be conducted to investigate the individual pastoral support programmes within computing departments to examine the potential for providing improved guidance and information provision to students (Tryfona et. al., 2013).

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