REPROGRAMMING 1ST YEAR STUDENTS: AN ACTION RESEARCH CASE STUDY

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Abstract

This paper depicts a large-scale intervention within a 1st year Computing undergraduate university cohort. The course is a full 20 credit, Level 4 module comprising of 120 1st years studying at the University of Central Lancashire (UCLan). The students are from all manner of academic backgrounds. Many have studied either Computing or IT at school or college, whilst others have not undertaken any previous or formal qualifications in the subject.

An Action Research study was organised and the content of the first module was redesigned to take students through a challenging (yet highly-scaffolded) project during the first four teaching weeks. This acted as an introduction to university life and the course in general. The rest of the modules followed on after this initial module finished, and was delivered in the more traditional long and thin mode.

The motivation for this study was to improve the student experience generally – whilst specifically targeting issues surrounding student engagement and retention in the 1st year. Additional aims were also to help students make the transition from school to University so that they will be better prepared to enter the 2nd year of their degree. Delivering the first module as a block enabled a small team of staff to work closely with students, building strong relationships at the start of their degree. This meant that students could be carefully monitored and supported at this crucial time.

The implementation of the 4WC has shown an improvement in student marks and student retention. The response to this intervention has shown that students have been enthused by the early results and are clearer about what they are going to study in depth later on. Consequently, students are more committed to the course, and retention rates have improved quite dramatically. In addition, students should be able to make better-informed choices about their future course options, having had exposure to the products on some of the different courses.

Introduction

1st year Computing students at the University of Central Lancashire (UCLan) come from all manner of academic backgrounds. Many have studied either Computing or IT at school or college, whilst others have not undertaken any formal qualifications in the subject. Computing is run as a common 1st year, with entry requirements of 240 to 280 UCAS tariff points at A2 or BTEC National Diploma MMM-DMM AND 5 GCSEs at grade C or above including Maths and English. Students study the 1st year to gain a grounding foundation in Computing, and then progress to year 2 where they choose a specialism. Specialisms range from Computer Games Development, Computer Network Technology, Information Systems, Forensic Computing, Multimedia Development, Software Engineering, and Computing, which is a student self-select course that offers a flexible programme of study.

Comments from students who leave Computing courses consistently point to a lack of understanding of what their course is about until too late in the year, when they slowly disengage as they realise it is ‘not the course for them’. Some also remark that they find programming boring and not relevant to their specific course flavour choices. Students want to start University and dive straight into the ‘fun’ stuff.

The motivation for this study was to improve the student experience generally – while specifically targeting issues surrounding student engagement and retention in the 1st year, and to help students make the transition from school to University so that they are better prepared to enter the 2nd year of their degree. Students worked in groups to design, build and market a treasure hunt Android application, which they presented at a final symposium at the end of their first four weeks of study.

Motivation for the Four Week Challenge

Higher Education is changing; one of the aspects of student learning that has been highlighted in recent years is that of student engagement (Barnett and Coate, 2005). There is a growing understanding that students are now arriving at Higher Education institutions with a different range of backgrounds and skills sets to ‘traditional’ university entrants (Franklin and Van Harmelen, 2007).

An audit of student retention in England (National Audit Office, 2007) found there to be scope for improvements. The audit held that actions taken to address this will become progressively central to retention, as widening participation interests more students prone to need support; it highlights a need to go further than purely focusing on learning shortfalls. Broadening participation initiatives, boosted student numbers and the monetary expenditures of Higher Education have elevated anxieties about the quality of student education and experience (Haggis, 2006).

Heaton-Shrestha et. al. (2009) propose that the most influential model developed to account for the early departure of students from HE is that of Tinto (Tinto, 1987), according to which, the student resolution to continue or withdraw is strictly linked to the degree to which he or she has achieved in becoming both socially and academically amalgamated into the institution. Forbes (2008) adapted this model, further considering the needs of part-time students, and including outside influences such as the necessity for earning money. This ‘new retention model’ highlights the significance of peer interaction to support retention. Forbes also highlights the importance of academic and social adjustment, and of suitable and correct information being given to prospective students before enrolment.

Educators have to re-evaluate both the approach of their delivery and their method of assessment, given that education has been experiencing a paradigm change away from teaching-as-instruction towards student-centred learning (Jonassen, 1993; Ramsden, 1992). Therefore, the curriculum has been planned more and more around learning outcomes as opposed to content (Lin and Hsieh, 2001). Kolb (1984) highlights the need for identifying different learning styles in students. He advocates that an individual gains knowledge through assuming a task. They then are required to reflect on the involvement and then try to fathom the experience through enquiry and conceptualisation. The individual then makes choices based on what they have learned, decides on their next action, and undertakes another task. Learning is consequently cyclical and certainly not ever reaching a completion. The practice is continuously recurring.

THE STUDY

Study Design

The structure of delivery of the 1st year has been redesigned such that the Computing Skills module (The 4 Week Challenge) will be delivered full-time over the first four weeks of the semester, acting as an introduction to university life and the course in general. The other five modules will be delivered concurrently over the subsequent twenty-two weeks of teaching, and will each build upon themes introduced in the first module.

Delivering the first module as a block will enable a small team of staff to work more closely with the students, building a relationship with them at the start of their degree, and allowing more careful monitoring and support at this crucial time. The experience of other universities has shown that by structuring the students' first few weeks this way, their expectations of being a University student in general, and their course in particular can be much better managed.

The re-structuring of the content of other modules builds upon the positive experience of the first four weeks, whereby students can appreciate how each module fits into a more integrated whole. The contents of several modules have been re-organised and updated so that they integrate more explicitly, enabling students to make the connections between subjects more easily, and allowing teaching activities to exploit the connections between modules in a more engaging way.

Participants

The participants in this study were 120 1st year Computing students in the School of Computing Engineering and Physical Sciences at the University of Central Lancashire. Of the 120 students, the large majority (93%) were classed as home students, the remaining 7% classed as overseas, Isle of Man and European students. Of the students classed as home students, 49% of the cohort came from Lancashire, 13% from neighbouring counties (Merseyside and Manchester), and the rest spread across the UK. 45% have A-levels, 41% have BTech Nationals, and 8% have BTech Certificates.

Average age of the students was 21, with 41% being 20 and 30% being 19. The youngest student was 18, and the oldest student was 52. 6% of the students were 25 or older.

An initial investigative questionnaire indicated that 42% of the students thought that they would spend 10-15 hours outside of class completing guided work, whilst 29% thought they would spend more than 15 hours. Most (92%) thought that the course would be very practical as opposed to theoretical in nature.

None of the students claimed that their reasons for attending university were to escape home. 1 student stated that they were attending university to partake in the social life, 1 declared the reason for being on their course was because their friends were on the course. Most of the students indicated they are at university to learn more about Computing and get a good degree.

Research Cycle 1 (Students and Group Work)

Group work is usual in a range of careers, particularly in anything concerning design and development. Consequently, group work in undergraduate courses is an imperative provision for professional careers, delivering a reflection of the real working world environment.

The UK's Computing professional body, the British Computer Society, also rates teamworking as one of the essential professional skills for any student on their accredited courses. Consequently, the need to update and redesign the existing curricula to provide stronger links between curricula and the professional best practices being implemented are very evident. Exploring the unspoken philosophies of curricula, Barnett and Coate (2005) identify a recent shift towards outcome-based, employment related and market oriented curricula that has generated a range of pedagogies to cope with the change.

Group work can incite students to be more supportive towards each other in their teams. Conrad (2009) highlights how learning teams can serve as forums where students may personalize their learning experience, and identify and correct misconceptions and gaps in understanding. The product of a meta-analysis carried out by Springer, Stanne, and Donovan (1999) in the area of undergraduate science, mathematics, engineering, and technology (STEM) courses reveal that small group undertakings foster more encouraging approaches regarding learning and other factors that eventually lead to students performing better in their education.

By considering group work as a way of addressing student needs with respect to retention and transition, and by designing a module approach that specifically develops this approach, a curriculum has been designed to address student needs, wider issues (employers), and professional principles.

Comments from students who leave computing courses consistently point to a lack of understanding of what their course is about until too late in the year, when they slowly disengage as they realise it is “not the course for them”. Students who leave also comment on the loneliness factor. An early withdrawal survey analysis by the University of Leicester (2010, p1) articulates, “Social factors such as friendship groups and housemates appeared more of a concern for undergraduate and first year students than postgraduate and second or third year students.”

Experience points to the advantages of engaging students in their subject early on in their studies, and creating the framework for them to form social groups, to reflect and to learn experientially. This is imperative to their academic success and also to their growth as professional computer practitioners. Barnett and Coate’s (2005) model suggests that while propositional knowledge is crucial, being able to apply that knowledge in practice is of even greater importance. Additionally, widespread literature advocates that the theory and practice of reflection has reached a weighty role in current professional education (Moon, 2004).

The requisite for fitting in at University can go towards clarifying a variety of student behaviours, cognitive, motivational processes, and emotions. For example, individuals expound the motives of their actions by linking them with the yearning to belong. Making friends leads to the experience of positive emotions such as happiness and joy, whereas shortage can cause the experience of negative emotions. As denoted by Maslow (1968), humans feel a basic requirement to belong, to be loved, and to be respected.

Sense of belonging in educational environments is labelled by Goodenow (1993) as the following: “Students’ sense of being accepted, valued, included, and encouraged by others (teacher and peers) in the academic classroom setting and of feeling oneself to be an important part of the life and activity of the class. More than simple perceived liking or warmth, it also involves support and respect for personal autonomy and for the student as an individual.“

The Sorting Hat

In order to improve retention on computing courses, the issues of student isolation, was highlighted as one of the most critical. Students were put into teams of six for the Four Week Challenge, encouraging the forging of friendships. Literature indicates that team size affects team performance. Both in scientific research (Tunzelmann et al., 2003) as well as in empirical work (Hoegl, 2005), a relation is established concerning team size and performance. An archetypal conclusion is that in the sciences around five to nine individuals is an ideal team size (Qurashi, 1993).

There were three options available for how teams were created. Option one was to allow the students to pick their own teams. This was discounted as it went against the teaching team’s desire to help students make friends and form social groups. Option two was to select teams based on degree course. This seemed attractive, as it would help the course groups to bond and form a strong identity. It was also a seemingly straightforward task that required little time and effort on behalf of the teaching team. On the other hand, it wouldn’t help students who were unsure about the course they had chosen (another of the reasons for doing the 4WC) and might lead to teams focussing on one aspect of the challenge to the exclusion of all else – reinforcing the ‘everything but X is irrelevant’ attitude we were keen to dissipate. Option three was to select teams that were inter-disciplinary. This was ultimately the preferred option as it was thought that with a ‘balanced’ team, each member would be able to contribute something of their specialism at different points during the challenge – increasing the likelihood of success. The staff spent a long time discussing the team structure, and how each structure would affect not only student activity, but also teaching practice and staff motivation. This is an example of the use of the Johns’ (2000) model of reflection used in the design of the curriculum. Although, as with all forms of reflection, this approach is couched in constructivism (Moon, 2004).

Previous experience shows that students report team working as the thing they like most and hate most about their degree experience, although they see the benefits (Tsay and Brady, 2010). Lots of things can go wrong, causing the team to break down. Payne et. al. (2006) aimed to identify weak elements of student group work. However, as the teaching team didn't know the students very well, they had little to go on other than the chosen computing specialism of each student. It was decided that it would be desirable to look at other things as well, so that the groups had a balance of interests that would see them though the 4WC activities, as well as a balance of personalities that would make it easier for the group to function as a team – some leadership, some technical expertise, and so forth. Gati et. al. (2010) argue that profiles are important in career decisions, so the teaching team decided to try and profile each student.

Connolly et. al. (2009) describes a longitudinal research study that investigates the variance of anxiety amongst undergraduate computing students, with specific emphasis upon their learning programming during their first year in higher education. According to Connolly, low retention rates in computing courses present a worrying concern. For some computing students, learning programming is intimidating, and causes a lack of confidence and anxiety. From a constructivist point of view, the lecturer's role is to ensure that 'alignment' happens, which includes creating an education setting that fosters the learning undertakings suitable to attaining the anticipated learning outcomes. Alignment is dependent on consideration being given to establishing clear learning outcomes, teaching methods, assessment procedures, an atmosphere encouraging to student/teacher communication and a sympathetic organisational environment (Biggs, 1996). The curriculum had to be designed so that programming was introduced in such a way that did not appear intimidating or cause students to immediately worry.

Part of the 4WC included a gentle introduction to programming using AppInventor. A small number of students arrive with significant programming experience, and it was thought desirable to distribute these students as technical experts within the teams, to ensure each team had a chance of tackling the more awkward programming challenges, and even out the competition.

It was decided that Belbin’s team roles could be used for inspiration on helping to sort students into their different group functions. According to Belbin (2004), each person can be characterised by nine role types. Belbin provided a clear insight into the internal group relationships and the clarification of the roles needed for a team to work efficiently. The resulting teams are called balanced teams.

Official Belbin questionnaires are not straightforward to administer (and cost money). For the subject, they require complex arithmetic (adding up to 10) and can be quite time consuming to complete. In this case, something more “lightweight” was required, an approach that could be administered electronically without supervision or explanation, as an additional part of an online survey that was already due to take place during Freshers’ Week as part of Induction (only 2 days before the start of the 4WC!).

Based on the descriptions of each of Belbin’s team roles (excluding the Specialist role), a list of 12 multiple-choice questions was devised, where each possible response indicated a preference for one or more of the roles.

The questions and responses were arranged so that each team role appeared the same number of times (10) across the entire question set.

When the students completed the survey, the responses were processed to give each student a score between 0 and 10 against each of the Belbin roles. The preferred role was then recorded for each student. Several students had two roles with equal scores, and in these cases both roles were recorded.

A thirteenth question was added, with a scale of responses to measure how comfortable and experienced the student was with programming. This was designed to replace the role of the Specialist. From the response to this question, those who indicated an existing aptitude were marked as such. Coincidentally, there was the same number of self-diagnosed ‘expert programmers’ as teams. Had there been too few ‘programmers’, the plan was to look at the next response down on the survey.

Creating the teams was achieved by creating slips of paper for each student, recording their name, course, preferred team role(s) and whether or not they were a ‘programmer’. These were laid out in course groups to begin with, and then arranged manually into balanced groups of 6.

The students were formed into teams the next morning, and immediately set to an ice-breaking activity. In the afternoon, teamworking was discussed formally, though not in depth. Hartley (1997, p104) argues that we should not be teaching these theories to students, but instead we should be “enabling our students to develop their own critical enquiry into the nature and processes of project groups”

The Theory of Constructive Alignment (Biggs, 1996) is highlighted as offering an explanation of how the 4WC meets some of the challenges we face in engaging students in higher education. Biggs’ Theory of Constructive Alignment suggests that, if any actual learning is to happen, that student characteristics, aims and actions must be consistent with those of the teacher-constructed learning environment.

Results and Reflection

A survey of the students towards the end of the academic year highlighted the following results concerning friendships:

87% agreed or strongly agreed that they felt they had a good understanding of what their course is going to involve over the next year or two.

88% agreed/strongly agreed that they were confident they were on the right course and would see it through to graduation at the end of the final year.

4WC friendships - 74% agreed/strongly agreed that working in a team during the Four Week Challenge really helped them to make friends and settle into University life.

4WC enduring friendships - 70% have kept in touch with at least one or two of their team-mates from the 4WC. 7% thought they were never really friends with any of their team-mates anyway.

These initial results are very promising and indicate that the 4WC met one of the primary aims, which was to tackle the isolation that new University students face when they first arrive on campus and start their course.

Looking at the data of actual academic results, some interesting issues can be raised regarding the 4WC as an early indicator of success/danger for students. Of the 24 students attaining <60% in the 4WC, none got >60% overall at the end of the year. Only 5 of those students got through the year without referral in at least one module. Indeed, everyone who got <55% in the 4WC has had referrals in other modules. Plotting the graph of 4WC results against average grade across *all* modules shows a general correlation. Worthy of note is the observation that a group of half a dozen students who did well in the 4WC have dropped off the graph overall. This could indicate to the assumption that they were ‘carried’ through due to the group’s efforts. Attempting to identify these passengers in the next iteration of the module run is important, and these results can provide a basis for targeting certain students that need monitoring and extra support.

In terms of retention, overall, there has been a 25% reduction in dropouts. 7 out of 9 dropouts (78%) happening within a couple of weeks of the end of the 4WC as opposed to only 42% of dropouts happening by the same date last year.

The implementation of the 4WC has shown an improvement in student marks and student retention. Feedback this year has shown that students have been both enthused by the early results they have achieved, and clearer about what they are going to study in depth later. Consequently, students have been more committed to the course, and retention rates have been seen to improve markedly. In addition, students should be able to make better-informed choices about their future course options, having had exposure to the products of some of the different courses.

Future Directions (Cycle 2)

One iteration is not enough to measure the impact, so September 2012 will see the implementation of Cycle 2 of this Action Research study. Around 120 students are expected to enroll on the Computing year 1 at UCLan, with varying degrees of Computing backgrounds and programming knowledge. In this iteration, the 4WC team plan to monitor group work far more closely, both from an academic viewpoint and from a social aspect. This will be done with the help of the University student advisers who are employed to aid in retention. Student teams will be required to have weekly meetings with the advisers, and they will be asked to reflect on the weekly tasks and fill out forms with pre-determined criteria. This will hopefully enable the teaching team to catch any issues early on and address them immediately.

Conclusions

The Four Week Challenge was initially established in response to the link between retention figures, the social exclusion of first year students, and the misunderstanding of what being a Computing practitioner really entails.

By recognising that first year students need support at multiple levels, the group forming approach was used not only as a tool to deliver content and assess the students, but also to support the students in learning from each other, assisting them in developing social networks. In agreement with Biggs (1996), whilst there was a clear idea about what skills the students should learn, this was not interpreted too narrowly, as there was a bigger picture to consider. From a curriculum design point of view, the aim of the 4WC is to prepare first year students for the rest of their studies at university, and not just teach them how to program.

As educators who are mindful of the importance put on these soft skills in the workplace, the assumption was that working in groups would be helpful for students (Green, 1997). Regrettably, this is not true in all cases. In many instances, first year undergraduates will only benefit from working in groups following a shift in their focus. The majority of Computing students stem from an education system that centres on tangible outputs; therefore, in order to gain any value from group work, the curriculum needs to display a similar focus on successful process, and an acknowledgement of the type of learning that this involves. A large number of the students already function as efficient reproductive learners, and this needs to adapt to take them further along the path to understanding.

From this exercise in curriculum design, two notions fundamental to attaining clarity have materialised, these are alignment and transparency of sharing. Obvious insights have centred around the notion that the that alignment of curriculum, reflection and experience is central to effective curriculum design. Additionally, a transparent method of evolving mutual understanding of what is being expected of student learners is key in creating a successful learning environment.

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