Informing Potential Computing Students

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Abstract

Two studies were conducted to examine the expectations computing students had held before they commenced their degree. We examined whether reality matched their expectations, how and whether they had tried to obtain information before enrolling in their degree, and how they were coping with their studies. Results showed that, for many students, reality did not match their expectations even when they had obtained information about their proposed degree. This often led to resentment and frustration. Solutions to this complex problem are proposed.

Keywords: information technology, multimedia, student expectations

Introduction

A concern with the fact that many Bachelor of Information Technology (BIT) and Bachelor of Multimedia (BMM) students at our campus try to do as little programming in their degree as possible was the basis for the present study. Given that many of these students say they hate programming and are "no good at it", the following questions arise:

- Why are they doing a computing degree if they hate programming?
- What did they expect to study in their degree?
- Where did they obtain information about their potential study?
- Is there some way in which they could have been better informed about their studies?

Unhappy students like those we encountered are probably found in all computing degrees. It is commonly reported that students find programming difficult (Jenkins and Davy, 2000) or that teaching it effectively is challenging (Fincher 1999) and various suggestions are given for making programming classes better (Bornat, 1987, Stein, 1998, Jenkins and Davy, 2000). The existence of unhappy computing students is a problem because in some countries there is a shortage of people with computing skills (von Hellens and Nielsen, 2001, Hill and Knowlton and Nexus Research, 2001). In some countries there is an attempt to attract more females into IT degrees because they account for a relatively small percentage of IT students and could help fill the shortage (Staehr, Martin, and Byrne, 2001, von Hellens and Nielsen, 2001). While attempts to make programming classes better or to attract students into IT degrees is important, it is also important to attract people who will enjoy their studies and subsequent work. Part of the problem is to ensure that High School students are well informed about IT studies so that those who are unsuited to IT studies will not enrol in a degree they will hate.

The current information given to potential students on the official tertiary admissions site for the BIT states "The first two years of the program involve the study of core topics which develop the mathe-

matical, logical, and programming skills necessary for program specification, design and implementation. Students are introduced to computer architecture, artificial intelligence, database systems, information systems, and project management. They also develop their written and oral communication skills. … in second and third years, students undertake a major project and specialise in one or more of: artificial intelligence; computing science; information systems; or software engineering. … Career opportunities: systems or application programmer, software engineer, analyst, database designer, communications specialist, quality manager, technical writer." The current information given to potential students on the official tertiary admissions site for the BMM states "In first year students are introduced to the disciplines and technologies used to design and develop quality multimedia systems, products and services. These studies include core components in design, multimedia authoring, Java programming, Web development, and sound production. Later years of the program cover the aesthetic, cultural, technical and management foundations of multimedia, with students able to develop specialised expertise in areas including sound, Internet computing, interactive entertainment, design, multimedia screen production and educational multimedia production… Career opportunities: Design and programming, maintaining, managing and developing multimedia systems, electronic marketing and publishing, sound and video production."

Our research aimed to examine what students expected of their degree, whether reality matched their expectations, how and whether they had tried to obtain information before enrolling in their degree, and how they were coping with their studies.

Study 1

Subjects

In our first study, 74 BIT students (61 males and 13 females) and 42 BMM students (28 males and 14 females), all of whom were nearing completion of their first year of study, were asked to complete a questionnaire. The degrees have two compulsory first year programming subjects in common, in which Java is currently taught. These programming subjects account for a quarter of the students' first year subjects. The BIT students must go on to do a third programming subject in their second year. The other compulsory subjects in the BIT degree are subjects which are quite common in IT degrees, such as mathematics, computer systems and networks, and information systems and, possibly less common, personal communication subjects. The other compulsory subjects in the multimedia degree are more "modern" subjects such as multimedia authoring, sound principles, computer visualisation and image creation.

Materials and Method

At an information session for students nearing completion of first year a questionnaire booklet was handed to each student. The booklet contained questions about what students had been expecting to study, how their expectations either matched or did not match reality, what they had based their expectations on, what they had done to gain information about their degree and whether they had considered dropping out. They were also asked to give suggestions on how the university could better inform people about what subjects they would be required to study for their degree.

Results

The results showed that many students said that at the time they enrolled to do their degree they did not know what subjects they would be required to study for the degree. The percentage of students saying this is given in Table 1 for both degrees and both genders.

Table 1

Percentage of male and female students from both degrees who said they did not know what subjects would be required in their degree.

IT		MM	
Male	Female	Male	Female
41	15.4	17.9	28.6

It can be seen that many students enrol in the IT or MM degree without knowing what subjects they will be studying. For the BIT students, males show a strong tendency compared with their female counterparts to enrol in their degree with no awareness of what they will have to study, with $p = .073$ on a one-tailed Fisher's Exact Test. Of those students who say that they knew to at least some extent what they would have to study most knew they would have to study programming, as shown in Table 2.

It seems, then, that most students who did have some idea of what they would be required to study did realise that the subjects would include programming.

Unfortunately, some students also found that their expectations were not fulfilled. There were a number of ways in which students' expectations were not matched by reality. For the BIT students, it was the inclusion of communication and information systems subjects which caused most surprise. Of the fifteen BIT students (12 males and 3 females) who said their expectations of what they would have to study did

Table 2

Percentage of those students who said they had some knowledge of what subjects they would have to study who realized they would have to study programming.

IT		MM	
Male	Female	Male	Female
93.9	88.9	83.3	70

not match reality, nine (8 males and 1 female) were surprised about the inclusion of personal communication and information systems subjects. Other, less common, causes of surprise for BIT students were the lack of emphasis on data communications, computer graphics and basic computing skills. For the BMM students, causes of surprise were more varied and were not so much to do with subjects covered but with the degree of emphasis on or difficulty of different subjects. Five students were surprised by the emphasis on or difficulty of programming. Another four students mentioned that the degree was harder and/or broader than expected and did not refer to particular subjects. Other surprises mentioned by individual BMM students were a lack of comprehensive subjects on Flash and Director, a large emphasis on web design, and the fact that sound principles and design principles were different from what was expected.

Given that many students enroll in their degree without knowing what subjects they will have to study or with misconceptions about what they will study, it is interesting to see how many have considered dropping out of their degree. The percentage of students who have considered dropping out of their degree is shown in Table 3.

Table 3

Percentage of male and female students from both degrees who said they had considered dropping out of their degree.

IT		MM	
Male	Female	Male	Female
23.3	50	33.3	35.7

There was a strong tendency for more female than male BIT students to have considered dropping out with $p = 0.067$ on a one-tailed Fisher's exact test. For the BIT students, there were a number of reasons given for having considered dropping out. The most common reason had to do with finding programming harder or more boring than expected, although this was primarily because of the female students, with 83.3% of the females and 21.4% of the males citing programming as the reason, a result which is significant with $p = .018$ on a one-tailed Fisher's Exact Test. The males made more general statements such as the degree is too boring, too hard, not what was expected, or not does not cover desired subjects. For the BMM students, 55.5% of the males and 16.7 % of the females who had considered dropping out considered the degree too difficult, too stressful, or too frustrating. In addition, 50% of the females who had considered dropping out cited programming being too hard as their reason for possibly dropping out.

The question arises whether the students who are unhappy were less likely to have gained information about their degree before they enrolled. It turns out that this depends on the degree enrolled in as the results in Table 4 show.

Table 4

Percentage of students from both degrees who did *not* obtain information about their degree as a function of whether or not they had considered dropping out of their degree.

	IT	MM
Considered quitting	5	28.6
Have not considered quitting	23.1	11.1

For the BMM students there was a tendency for those who had considered quitting to be those who had not obtained information. In contrast, for the BIT students, there was a strong tendency for neglecting to obtain information to be more common in students who had not considered quitting, with $p = 0.067$ on a one-tailed Fisher's Exact test.

It is apparent that many students are unhappy about what they are studying and that information they obtained about their degree had not been sufficient to allow them to see that the degree was inappropriate for them. One question that arises is: where did the students obtain their information? It turns out that they obtained information from many sources, as shown in Table 5.

It is interesting to note that the students cite the same sources for both correct and incorrect information. A tentative explanation for this could be that the students are focusing on different aspects of the information, depending on their interests, and that the volume of the information is somewhat overwhelming, leading them to miss crucial aspects of the structure of the degree.

Table 5

Sources cited as giving correct or incorrect information

Correct	**Incorrect**
current students	current students
past students	past students
high school friends	high school friends
the enrolment guide	the enrolment guide
websites	websites
people in the industry	
computer magazines	
teachers	

It is disturbing that even sources that should help are sometimes seen as not giving accurate information.

Students were asked for suggestions on how they could be better informed. The major suggestion was to have a better website. Suggestions they made for improving the web site were:

- provide information on assessment
- include examples of work
- include comments from past students
- include information about popular subjects
- list applications that will be used
- provide more information on the different concentration areas
- provide more information on different degrees
- make subject outlines easier to access
- include a very basic list of subject names all next to each other
- make the website easier to navigate
- make the website more user friendly
- keep the web site up to date
- include a PDF document that can be downloaded for easier reading
- use terminology prospective students can understand

The second most prominent suggestion was to provide more information on programming. The suggestions made in this regard were to inform prospective students:

- that programming is hard
- of the extent of programming studied
- of other degrees that would be more suitable for those who are not good at programming

Students also suggested:

- providing booklets to high school students explaining the degrees in detail
- providing quotes from students

- having staff visit high schools
- telling students what software they will use

The results of Study 1 suggest that many students are unhappy and feel they were misinformed or ill informed about their studies. While some qualitative data were obtained from Study 1, we were particularly interested in obtaining more qualitative data in a second study to closely examine specific issues such as:

- student level of understanding of the scope of their field of study
- the impact of expectation/content mismatch on the level of interest and academic effort
- coping strategies employed when content did not match expectations, and
- possible solutions for improving the accuracy and relevance of information for prospective students.

Study 2

Subjects

In our first study, 74 BIT students (61 males and 13 females) and 42 BMM students (28 males and 14 females), The subjects in our second study were 85 BIT students (62 males and 23 females), 11 BMM students (7 males and 4 females), and 2 male BIT (Advanced Studies) students, all of whom were completing a compulsory writing skills subject. Some of the students had participated in Study 1.

Materials and Method

The end of semester examination for the subject Writing Skills required students to write a one page essay to demonstrate proficiency in written English. They were asked to write a one page essay, in an exam, on the following topic:

> *"Some students find certain aspects of what they have to study for their degree match their expectations while other aspects do not"*
>
> *Discuss the following: The way in which what you have had to study has or has not matched your expectations, how you feel about this and how it influenced your studies*

Students were informed that the essay question formed part of a research study, and were asked to indicate their consent (or otherwise) to having their essay included in the study.

Results

The essays provided further insight into the rationale behind student opinion, feelings, and degree selection. Students reported diverse reasons for selecting computing as a field of study. Some students based their choice on prior exposure to technology and a general interest in the area. Typical responses were:

> *"As I was computer crazy, I was very excited to start the course as soon as possible, …"*
>
> *"the reason I decided to study information technology is because I liked studying computers at secondary school."*
>
> *"I'd thought for many years of turning my interest in computer programming into an occupation. "*
>
> *"During my studies in high school I was good at using computers, which is why I chose to do this course."*
>
> *"I have always been interested in computers so I felt that I would enjoy a computer based career."*

Others reported possible employment opportunities or advancement as the primary factor. Examples of typical responses are given here:

> *" … it was time to consider achieving formal qualifications to complement my work experience."*
>
> *"When I started my higher studies I had a goal to achieve. At that stage I thought only about the employment prospects."*
>
> *"I was studying [the] aviation degree before I started my IT degree. The main reason for choosing to study IT is that there are many job opportunities available."*

The data revealed that a large proportion of students (40.8% in fact) found that the subjects they encountered did not match their expectations either in content or emphasis and, consequently, many students were unhappy:

> *"When I began university … I was horribly disappointed. Only one of my subjects involved any programming – the rest were all theory based subjects. Even more upsetting was that the remaining subjects were almost all business related."*
>
> *"… where is the education we need for the real world.."*
>
> *"I am not happy that there are no subjects that relates (sic) to the Oracle language and I am extremely unhappy that there is no major for networking … "*
>
> *"Firstly, I never imagined that there would be so much theory in such a technical course."*

Students also commonly reported that while they knew a subject was included within the degree structure they were surprised at the level of emphasis placed on it. This is particularly true for the programming subjects. Students expected to undertake programming whether undertaking the BIT or BMM degree, but were often surprised, with negative consequences, at the amount of programming required:

> *"One of the things I didn't expect was the amount of programming subjects. … I didn't expect two whole core subjects devoted to java programming. This is why I picked multimedia over IT, to get away from the whole programming side of things."*
>
> *"Are communication skills important? …Should they take up so much of the degree? I believe not."*
>
> *"I was surprised …to find that in the first year of this degree, I had to study two forms of maths … I had no idea why I would have to study these maths subjects …"*
>
> *"I was surprised that we had to learn business skills such as report writing and how to be effective speakers. I thought that we only had to learn how to write programs."*

While many academics would hope that students were at least interested or perhaps even enthusiastic about subjects, the following responses unfortunately show a different viewpoint.

> *"Studying programming … is just a necessary evil."*
>
> *"…I came to realise that it did not matter so much about the exact content of subjects. They are just a means to prove that you have an understanding that employers desire."*

Far from feeling enthusiastic about aspects of the chosen field of study, many students show a level of resignation and acceptance of prescribed subjects. Students are prepared to 'take their medicine' if they perceive that there will be some future benefit for their career:

> *" … I have struggled on numerous occasions with these unexpected subjects, but even though I hate them now, I know they will be helpful in the future."*

Many students place a large amount of faith in the university to deliver worthwhile content through a relevant course structure, and some students have a strong belief that the university will provide the requisite knowledge for an appropriate graduate outcome.

"… I may study some subjects … I don't wish to study but I strongly believe those unwanted subjects will make me [a] smart man."

In some instances, students appear to have an internal benchmark against which they test the usefulness of a subject. To be considered useful the subject must be strongly identified as contributing to a component of a future career:

> *"I want to be [a] designer, but I have to spend so much time and energy learning … programming which I will have little chance to use."*
>
> *"It is hard to put effort into subjects that you feel will not help you land a job."*
>
> *"… how does learning this crap relate to becoming an IT specialist?"*

When discussing subject content, students refer to the 'real world' and a need to solve 'practical or real problems'. It is apparent that hey often find it difficult to clearly see links between theory and practice. Where a subject is not in line with expectations of future careers or work tasks, students often classify the subject as boring, tedious, or useless. For example,

> *"[some] aspects of what I have to study for my degree do not match my expectation[s] I called them so-called "boring and "useless" subjects or courses. I find most of them are too theorical (sic) [they] provide [only] basic knowledge and have no direct relationship with my future career, …"*
>
> *"Firstly, a lot of subjects in [the] IT course are very boring and not very useful."*
>
> *"… most of the things taught here are irrelevant in the real world."*

Some students adopt a strategy for surviving the subjects that they find useless, boring, or tedious. The strategy might be identified as 'minimum input (effort) for expected minimum results (mere pass)':

> *"Due to a low interest [in] the maths subjects, the amount of study I did was minimal (enough for a pass). For all my other subjects, (which met my expectations.) I tried very hard, and regularly received distinctions."*
>
> *"Subjects that I had expected and wanted to do, received a greater proportion of my academic effort"*
>
> *"In my case, I've found that some subjects which are obligation (sic) … are unnecessary to me, so I didn't study hard."*

This strategy was mentioned by approximately 14% of BIT respondents, but no BMM respondents.

For many students the strategy seems a reasonable one for survival. However, a problem develops when a student perceives that an undesired subject requires more than the anticipated minimum effort in order to achieve a minimal passing grade. Where this is the case students report resentment.

> *" … why should students like myself have to study … maths and logic? It is not only a waste of time, but also a waste of money. … I was not good at maths but very capable of programming. As a result I failed [maths] and had to do it again. This not only wasted time and lots of money, but also proved useless as I have not yet used any knowledge from [maths]."*
>
> *Both … programming and design are time consuming, if I spend time for programming, I will have less time to do my design. This made my learning for both … subjects harder. "*

A small number of students felt unsure that a computing career was appropriate for their skills and interests even though they enjoy using computers. The experience of undertaking prescribed subjects in which they have little or no interest causes some students to reconsider their choice of career at a fundamental level:

> *"At this stage … I still do not feel that information technology will provide me with what I thought it would. The kinds of jobs open to IT graduates all seem to be related to the types of subjects I detest. So while I will probably complete my course, I still do not know if I will use those skills to get a job, or search for a more agreeable career path."*

While many students reported a mismatch between expectations and subject content, most students did enter their degree with a reasonable level of understanding of the general scope of the field of study. However, a small number of students found that the degree was significantly different from their understanding.

> *"…I was expecting to learn how to fix the computer … IT does not teach you how to fix your computer if something were to go wrong with it. It teaches you how to write program [s] … among other things."*

> *"I believe that as an Information Technology professional, my job would be to make sure that the product sells and not to make it"*

Students in both studies reported that information they obtained about their degree had not been sufficient to allow them to determine that the degree may be inappropriate for them. Students commented that it was not until subjects were started, or in some cases completed, that they gained a realistic understanding of the scope of the subject content. In addition, some students stated that it was only after completing a suite of subjects (usually a semester's worth) that they could begin to understand the dependencies between subjects and the relatedness of some subjects to their field of study. Even proactive (and experienced) students report finding it difficult to distil meaning from the information provided.

> *"I have started study in three separate courses … Each time I tracked down information sheets and looked on the website. Each time, after studying a course for a semester, I finally worked out exactly what the course was about. … I think the University does a bad job of informing prospective students about subjects. The descriptions given are full of catchy phrases and technology buzz words, but it is so hard to find out what work you will be doing in the subject."*

It is important to make students aware not only of the existence of a subject within a degree structure but also of the emphasis and context of the subject's content.

> *"Just say, … that a student was looking at taking a sound subject. He or she would look up the description on the website and see that the subject was 'introduction to sound'. Does that mean an introduction to sound in the context of the [BMM] degree? Or does it mean an introduction to the scientific definition of sound?*

Similarly, in Study 1, a student reported that:

> *"[the title Multimedia Authoring] does not mean "A crash course in Director" to the lay person."*

Where subject emphasis and context are unclear, a prospective student will have a poor understanding of the actual content to be studied and may feel frustration or resentment.

> *"The only information … available about a subject is a short summary, usually around three sentences which does not provide adequate information."*

> *"I was in no way prepared to encounter programming or scripting of any kind - my results last semester reflected this … I do believe that further warning could have been given in the … guide".*

Similar statements were found in Study 1:

> *"[I] looked on the web, but it didn't provide specifics i.e. which programs would be used etc. And it was all foreign to me. I didn't pursue it further because I didn't know where to look".*
>
> *"[I looked] though subject descriptions on the web page … which really didn't mean much to me at the time".*
>
> *"A high school student finds the site overwhelming and confusing".*

Discussion

It is disturbing to think that our results suggest that there is a lack of comprehensible information for prospective computing students. While institutions and government organizations often produce large volumes of information for prospective students, it seems that much of the information is inaccurate or not presented in an appropriate format and hence is not appropriately understood.

One problem may be that, as reported by Hill and Knowlton and Nexus Research (2001) there is a lack of definition for 'information technology' (including multimedia) and this contributes to the general lack of understanding of the scope and diversity of computing as a field of study. Our results do suggest that the terms 'information technology' and 'multimedia' are interpreted differently by each student. Many students enter their degree only to find that their understanding, or definition, of computing was different from that of their university. Our research also indicates that this lack of definition has significant consequences for many students studying computing at our institution, with many students reporting unhappiness and disappointment with their course.

Our research has shown that there are two primary issues that need to be addressed. First, computing schools need to realize that there are potential problems with subjects such as programming in that many students (especially females) find the subject boring or difficult (see also, Bornat, 1987, Stein, 1998, and Jenkins and Davy, 2000). Second, computing schools must ensure that the information they present to prospective students clearly describes the degree content in plain language and that the degree of emphasis on different subjects is clear.

One suggestion to help deal with problems stemming from difficulties with programming subjects would be to offer students a choice in the delivery style. For example, students learning Java could choose between a visual style using applications such as Visual Café, or a traditional style where code is written using only a text editor. It may be that students who are more visual would find the visual style more interesting and intuitive. It may be, however, that some students truly do not have the required mental makeup for programming and should perhaps never enrol in a computing degree. Computing schools should therefore offer programming familiarisation workshops during their public information days. These workshops would allow students to experience programming *prior* to enrolling in their degree. This could allow some students to realise that a computing degree is not for them, saving them significant time and money. Alternatively, for students who felt that they may struggle with programming, the workshops could serve to alert them to the need for additional time to investigate support strategies such as outside tutoring or institution funded learning support.

It is clear that more effort is required to produce information about computing degrees. As responsible academics, we need to ensure that the people we attract into our programs have made a choice that is both informed and appropriate for these skills and interests. We can do this by ensuring that the information we give to potential students and career advisers meets the following criteria. The information must:

- be written in language easily understood by high school students
- avoid the use of technical language, buzz words, and jargon

- be of a size that is not daunting to high school students
- be presented in a limited number of formats (hence avoiding confusion)
- include a range of opinions from current students
- include case studies of graduates showing their student and subsequent work profiles
- provide information on assessment
- include examples of work
- list applications that will be used
- provide a list of required subjects and their outlines specific to an individual's possible enrolment
- be easy to navigate
- be up to date
- suggest alternative degrees for students not interested in particular core components of the degree

Institutions and governments need to recognise that simply attempting to attract more people to computing degrees will not necessarily help relieve the problem of a shortage of skilled people in the computing industry. To produce enough skilled graduates, the people who are attracted must be suited to computing studies and the computing industry and the manner in which subjects are taught must cater for different learning styles and backgrounds. While it is true that an institution cannot hope to provide an appropriate 'fit' for all students, by providing prospective students with a rich and accurate picture we *can* hope that students coming into computing degrees are doing so only after being appropriately informed.

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