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Developing a positive experience of introductory information systems for women at two Australasian universities

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Abstract

This paper examines how academics can contribute to encouraging greater uptake of IS majors by women. Using a qualitative reflective approach we identify the perceptions and experiences of female undergraduates taking introductory IS courses in two universities, one in Australia and one in New Zealand, and discuss ways in which to improve their learning experience. We examine ways to improve the delivery of introductory IS courses in order to make information systems more relevant and less dreary to women undergraduates. The paper concludes with some recommendations for marketing courses and areas of further research.

Keywords

Information systems, gender, IT related degrees

INTRODUCTION

> *"As an industry some of our role models aren't necessarily the coolest people out there. I'm not sure that Bill Gates, for example, is the natural turn-on for a 12 year old girl"*
>
> (Katrina Troughton, IBM NZ Managing Director)

There is a real and growing shortage of information technology (IT) professionals in the workplace (Dept of Labour, 2005). At the same time there is a decline in the number of women entering IT related professions, thus exacerbating the skills crisis in the industry. The decline of women in IT is well documented in both the business press and in academic research. The reasons given for the decline are many and varied. Armstrong, Riemenschneider, Ried & Allen's (2004) study looked at the reasons for women leaving the profession. They concluded that the reasons are contained within three loops; managing family, need for flexibility of work schedule and stress. This is further borne out by an Australian State Government report by the Department of Women (2002), which found that women who work in the industry rate technology and telecommunications highly for flexibility and career support, but very low when it came to having a family friendly workplace.

Whilst the work-life balance is a reasonable explanation for women leaving the IT profession, it does not explain why women are not entering the profession in the first place. Fewer women are studying IT related courses and this obviously has an impact on their future careers. At the same time, high enrolments in business degrees mean that many women are exposed to information systems courses as first or second year undergraduates. These courses are often compulsory for business students. They are introductory and seen, at least by Schools of IS, as a good opportunity to recruit more students to IS majors via a business pathway. Our research suggests that such courses are unpopular with female undergraduates and do not attract them to consider changing from business studies to studying for careers in Information Technology (IT) related positions.

The contribution of this paper is to determine ways to develop more positive experiences of studying for an IT related degree. We concentrate specifically on introductory Information System (IS) courses and determine what steps we, as academics responsible for teaching these courses, need to take to encourage greater uptake of IS

majors by women. This paper takes a qualitative reflective approach based on the experiences of two university academics: one in New Zealand and one in Australia, both of whom teach introductory Information Systems.

Although this paper addresses IS courses, the literature encompasses the broader spectrum of IT as the issues relating to the IT sector include those of IS and the latter is rarely addressed separately. We first examine the literature on IT related gender issues and the arguments for why the number of women choosing IT courses remains very low. We then identify the perceptions and experiences of female undergraduates taking introductory IS courses in our two universities and discuss ways in which to improve the learning experience. Finally, we consider ways to improve the presentation of such courses to prospective students to encourage better uptake of IS majors by women.

CONSTRUCTS OF GENDER IN IT

Technology is seen as stereotypically a male domain in a popular culture that continues to associate occupations with either a male or a female bias (Lee, 2005). Despite arguments that gender is no longer an issue in a dynamic labour market where there is a high demand for IS professional (Sumner & Niederman, 2004) women account for less than 20% of the IT workforce (Goodwin, 2006).

This has become a political issue as the lack of women in IT amounts to a classic example of horizontal occupational segregation (Griffiths, Keogh, Moore, Tattersall, & Richardson, 2006). Griffiths et al., explain that horizontal occupational segregation shows how different groups of people (for example, men and women) tend to work in separate occupations. Women are therefore clustered in traditional career roles of teaching, nursing, and domestic service work (Anker, 1998 cited in Griffiths, et al., 2006). Furthermore, within particular industries, women are tending to be under-represented at the higher managerial Information Systems levels (such as Chief Information Officer), and are more strongly represented in lower level IT occupations. This is a classic case of vertical gender segregation.

Much of the research on gender imbalance in IS and IT related managerial positions focuses on the work-gender imbalance (Griffiths et al., 2006; Griffiths & Moore, 2006; Moore, Griffiths, & Richardson, 2005), with the unsuitability of the IT workplace, the deeply ingrained masculine culture of IT, the long hours, “presenteeism”, and difficulties with obtaining part-time employment all being cited.

The reasons attributed to gender imbalance also focus on the different attitudes to computer technology where women are seen as computer-phobic or computer reticent (Turkle in Christensen, Knezek, & Overall, 2005). IT has an image problem where boys who excel at computing are seen as ‘nerds’, ‘geeks’ or ‘trainspotter types’ with a lack of social skills (Lee, 2005) while girls are perceived to be more social and find IT subjects in school ‘boring’. Research suggests that lack of role models and the occupational culture of IT project a negative image to women (Sumner & Niederman, 2004). Lack of career information for a technology orientated career is another cited problem (Morris, 2002) and research has found that women often lack confidence in their own abilities and assess their skills at a lower level than their male peers (Hargittai & Shafer, 2006). These issues are less prevalent for females with a family member or friend in the IT industry as this contributes to a more accurate picture of such careers than those who relied on second hand knowledge (Lee, 2005).

Pinkard adds unequal access and an adverse climate in higher education as barriers to encouraging women into IT (2005). She argues that a key cause of the different attitudes towards computer use is the perception of software as male orientated with stereotypical characteristics that did not target or attract women. This identification of software as dominantly male resonates through the literature (Baroudi & Igbaria, 1995; Morris, 2002; Trauth, 2002). Lee (2005) states that not only software but technology “is gendered from the outside by those appropriating it rather than necessarily on the inside or at the point of design” (p123). This argument supports research into the consideration of two viewpoints into perceptions of IT and gender: essentialist theory versus social construction theory (Trauth, 2002).

Essentialist theory is based on the assertion of inherent differences between the nature of men and women. This argues that biological determinants dictate reaction to IT and we must therefore concede that women will require different methods of training than men to enter the IT workforce (Trauth, 2002). The implications for bridging the gender divide at school and university levels are significant.

The identification of ‘gendering from the outside’ (Lee, 2005) adheres to the theory of social construction. If IT is seen as male dominated because of societal perceptions then females are less attracted to the technical workplace and this reinforces the identification of computing as ‘men’s work’ (Trauth, 2002). Agreeing with this theory and addressing the problems it raises are two very different things.

One significant initiative that addresses the male stereotyping of IT is the ITBeat project in the UK (Lee, 2005). The project aims to make ICT glamorous and appealing to girls by introducing appropriate role models,

associating fun with computers and using images that relate to girls' perceptions of themselves. In making computing more of a 'female domain' (Webster in Lee, 2005) the project encourages positive images amongst those girls involved and supports their development of technical knowledge. However, Lee highlights the problem of applying feminine stereotyping and developing gender specific affinities rather than unifying social constructs in a genderless context.

GENDER AND IT/IS EDUCATION

> *"The school curriculum doesn't have a lot of credibility…..IT is not regarded as a prestigious subject. It's the sort of thing they quarantine the hopeless into, really"*
>
> *(T Clear, AUT in Hendery, 2006)*

There is widespread concern at the low level of enrolments in IT degrees in many countries (Denning & McGettrick, 2005). In a recent study across Australia and NZ a recruitment firm report found having a tertiary IT qualification was considered of major importance to 77% of employers surveyed (Rossi, 2006). In NZ universities the total number of students enrolling for IT related degrees has fallen for each of the past four years This was attributed by academics at a recent government conference to the 'geeky image' and lack of broad appeal (Hendery, 2006). Another factor was considered to be the lack of credibility in the school curriculum and the failure of the tertiary sector to adapt to 'what the kids can do with ICT'(Hendery, 2006).

The drop in student numbers is particularly prevalent amongst women; for example in Australia women account for less than one fifth of IT graduates (von Hellens & Nielsen, 2005). There are several factors that are held to influence the low take up of IT degrees by women including social and cultural issues (von Hellens & Nielsen, 2005), lack of role models (Trauth, 2002) and an overwhelmingly male environment (Baroudi & Igbaria, 1995).

Research into school age children has found that the girls' technical abilities are as good, if not better, than boys at primary age (Christensen et al., 2005). Differences begin to appear after Grade 6 and as the children reach high school age the enjoyment that girls find in using computers falls. More importantly, there is evidence that their self-assessment of their skills declines and they are less confident of their technical abilities (Hargittai & Shafer, 2006; Jewell & Maltby, 2002; von Hellens & Nielsen, 2005). Nevertheless, girls' use of email and their level of web skills remain higher and appear to be influenced by the social enjoyment aspects gained from online use (Christensen et al., 2005). In high school, a distinct difference becomes visible in gender attitudes towards computing and IT and the 'geek' image gains more credence, with girls finding the studying of IT to be boring and difficult (Lee, 2005). There is a perception amongst girls of this age that careers in IT lead to a solitary work environment with little contact with people and an emphasis on mathematical abilities (von Hellens & Nielsen, 2005). They appear to believe that a special aptitude for computing is necessary, while males see computing as a technical challenge that can be mastered (Jewell & Maltby, 2002). However, it appears from Jewell & Maltby's study that girls are not deterred by the level of difficulty but rather by the perceived lack of social involvement arising from an IT career.

The aversion of girls to IT related courses may also be affected by the lack of women role models in the teaching profession (von Hellens & Nielsen, 2005). This point is echoed in Trauth's (2002) call for more women professors of IT and Sumner and Niederman's (2004) observation that less than 7% of faculty IT positions are held by women. Some support for the role model argument lies with the observation that single sex schools have more success in promoting IT as a career (Trauth, 2002) although it is not clear what percentage of IT teaching staff in such schools are women.

Lang opens up the role model argument to suggest that the inequality in numbers is also evident in other disciplines such as law and medicine, but that these faculties have few difficulties in attracting female students. Therefore image may have a bigger influence than lack of role models on the low numbers of women in the IT discipline. These low numbers, of either gender, have serious consequences for the IT sector and the broader economy. In 2003, the NZ government concluded that the shortage of appropriately educated graduates was a major constraint on the growth of the country's ICT sector (Dept of Labour, 2005); a situation that has not changed.

Lang also argues that intervention programmes rarely sustain improvement (Lang, 2003). The concerns of IT education must therefore be addressed at several levels and academics responsible for introductory university IT related courses must play a role in making courses more accessible and relevant to students.

RESEARCH DESIGN

This paper uses the experiences of two university academics; one in New Zealand and one in Australia, both of whom teach introductory Information Systems. The Australian case is from a School of Management

Information Systems in the Business Faculty while the New Zealand study is based in an Information Systems Discipline Group within the College of Science.

Two different approaches were taken to data collection and preliminary analysis although the same themes were used for both universities. These are summarised in Figure 1. After preliminary analysis, joint discussion of the results, following the same themes was used to compare and contrast our experiences. A reflective interpretive approach was taken to meet the needs of our research that derive from our efforts to further develop our first year Introductory IS courses to make them more applicable, accessible and even enjoyable for female students. We hope that this will encourage greater uptake of IS majors by women (and increase the number of our female colleagues).

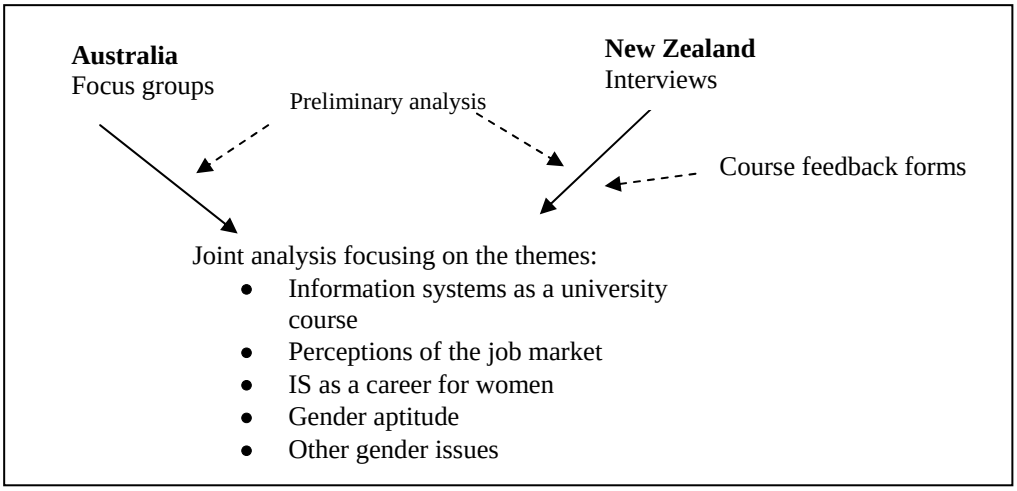

Figure 1: Approach to data collection and analysis

The Australian experience

Approximately half of all students studying Information Systems in first year at the Australian university are women, and yet less than 10% of women graduate in an Information Systems discipline. A series of focus groups was set up to explore the issues; namely, why women don't proceed to an Information Systems major. There were six focus groups in all, three consisting of only women, and three consisting of an equal mix of men and women. School leavers and mature age students, and local and international students were also equally represented. Each group had six students in it. The groups were asked to discuss the sorts of jobs women could have if they majored in IS, what IS involved, why would IS make a worthwhile career for women, and what are some of the issues that would turn women away from IS, and which gender would be better at IS. Many of the outcomes of the focus groups are reflected in the literature

The New Zealand Experience

Introductory Information Systems is a compulsory course for all business and communications students in the NZ university. Therefore slightly more than half of the course are women although only a very small percentage of IS graduates are women. Informal, semi structured interviews were conducted with 14 students (11 female and 3 male students) at the end of the semester to explore their perceptions and experiences in taking the course. Additionally, 211 course feedback forms were analysed to gain further insights. The forms were not directly related to this research but asked for general comments on the lectures and the computer lab work. They provided secondary data for the extraction of comments that related to gender issues. Cultural issues were not specifically addressed although we recognise that there are different perceptions between cultures and the issue of technology (von Hellens & Nielsen, 2005).

STUDENT PERCEPTIONS OF INFORMATION SYSTEMS

The findings from the two universities are discussed and related to the literature to identify where improvements can be made to encourage more female students to undertake IS degrees.

What is Information Systems?

There were many conflicting ideas about what constituted IS, with the males and females both appearing to be confused about the differences between IS and IT. Many saw IS as a subset of IT, rather than the other way

round, and felt that IS would not give the students as many skills as an IT or Computer Science major. Many of the women involved in the focus groups were headed for the "soft" majors of marketing and management, and felt that IS would not help them in their careers. Even the girls who were choosing to do Accounting and/or Finance, felt that IS was "someone else's problem". These views were articulated repeatedly in the focus groups. From a NZ perspective, the understanding of information systems as distinct from IT was addressed early in the course, when it became clear that few students could discern the difference. Responses to 'why IS?' were closely aligned to those of the Australian students with most of the women taking business majors in Management and Finance. Interestingly, it was the men who saw it as necessary to understand the role of IS in business 'so you can tell your workers what to do and understand what they are capable of'.

Excel and Access are taught and tested in practical lab sessions in the NZ case by request of the Business Faculty. Labs are optional and the higher percentage of women attending bears out the argument that women have a less confident view of their own skills (Hargittai & Shafer, 2006). The difference in ability was not reflected in the lab outcomes where test results were even across the genders. Both the interviews and the feedback forms showed that women were more positive about the use of these software applications, and the male students thought that learning them was a 'waste of time'. Two mature students were competent in both applications from their employment and emphasised how important it was to learn them.

Types of jobs in IS

Almost all the students saw a career in IS as sitting in front of a computer all day, either programming or manipulating software. Only two of the Australian students (both men) understood that IS is a "people" profession, involving talking to people, understanding job requirements, making decisions and managing effectively based on the information provided by the information system. All of the women felt that a job in IS would be boring, uninspiring, with constant effort required to keep up to date, reflecting the argument that IT disciplines have an image problem (von Hellens & Nielsen, 2005). The women also saw IS as a "nerdy" profession, and cited the stereotype of the "geek" living in a solitary, antisocial world (Lee, 2005). Not one of them saw the area as dynamic or exciting. Many of the women felt that if they were to major in IS they would be relegated to jobs in web design or simply users of a system. They had no concept that they could have input into the design of the system itself, or that they could influence the ways in which technology was used in an organization.

In NZ, a positive experience was found in the use of guest lecturers who were able to relate IS to the lives of the students. This was particularly true in health informatics, mobile business and security where feedback from students was overwhelmingly positive. These were topics that bore direct relevance to student lives and could be seen as support for the argument of role models in that feedback forms had comments such as 'I could see myself doing that' and 'using IS in health care really contributes to society' (Sumner & Niederman, 2004).

Would IS be a worthwhile career for women?

In the Australian university two of the women and five of the men agreed that IS could be a worthwhile career for women, but when asked why, they struggled to articulate any reasons. This reflected the case in NZ where only one of the women interviewed had any intention of working in an IS career. This student is a Pacific Islander and wished to contribute to her country's urgent need for more trained IT people. This appears to be more in line with a traditional career role choice of contribution to society that underpins the dominance of women in the so-called caring professions (Griffiths et al., 2006).

One of the Australian students did ask the researcher why, if IS was such a great career for women, was there only one woman academic in the School of Information Systems? This was a very pertinent question, and it is one that the researcher has struggled with herself (being that lone woman academic). Although the NZ University has three women out of nine lecturing staff, the four IS tutors are women. This gives the impression of a greater gender balance than actually exists. Half of the students thought that a woman lecturer was employed to teach the first year course to make the subject "more accessible', implying that female academics are more suited to a nurturing role. This gender stereotyping was more evident on the part of the women than the men.

Failure to attract women into the discipline in academia has to have a significant impact on the way the profession is viewed. The under-representation of women in IS schools does not go unnoticed by the students and may have a significant influence on the image of IT careers as a male dominated domain (Sumner & Niederman, 2004; Trauth, 2002; von Hellens & Nielsen, 2005).

Are men better than women at IS?

A review of the results over the last three semesters at the Australian university highlights the fact that the High Distinctions in Introductory Information Systems are split fairly well into 75% for women and 25% for men, and the students who fail are split evenly between the two genders.

However, when the students were asked which group would be better at IS, 34 of the 36 students said that men would be better. When asked why, they thought that men had more logical minds, were better at computing because they played games all the time and experimented with software for their personal use, are able to use the technology more proactively, and enjoy technology more. When it was pointed out to the students that women tend to shine in IS, and that the top five students in introductory Information Systems the previous semester were women, they all felt that this was a statistical aberration and that the women must have been "nerdy, mature age types". Two of the mature age women in the focus groups felt that they struggled with IS because they wanted to understand exactly how everything worked, although they did not feel like this about other technologies such as the telephone, television and motor car.

These results were mirrored in the outcomes from NZ although the data were only available from one semester. Two of the three top students and nine out of the top twenty were women. Failure rates were relatively evenly split with slightly more males failing than women. Mature age women tended to succeed more than any other group. Two of the NZ students were over 35 and both gained top grades from the course. Their experiences reflected those of the Australian students in that they felt they had to know and understand everything relating to IS technology.

What are the issues that turn women away from IS?

Further issues that turn women away from IS also reflect the literature on 'gendering' (Lee, 2005). The identification of IT as 'men's work' results from societal perception of gender roles. The male dominance in the IT workplace reinforces the identification of computing as something of little interest to women (Trauth, 2002).

Many of the women students said that they were not stimulated to learn about computers and IS, and saw technology either as a tool or as some science fiction fantasy with which they would probably never engage. It is tempting to assign essentialist theory and assert that these attitudes arise from inherent differences between the genders (Trauth, 2002). However, women students in NZ who were familiar with practical applications of technology in the workplace were more interested in computing and what could be done with it. Although their views supported the identification of technology as a tool, they did agree that social benefits of the Internet, mobile phones and such like were extensive and could be fun. Nevertheless, women saw themselves as users of the technology, rather than as drivers. They struggled to see themselves in a position where they would dictate the IS policy within an organization, in spite of having studied numerous case studies that had women in roles of CIO.

The men in the groups could not really think of many reasons why women would not want to study IS, particularly as there were so many men involved! This, of course, led two of the women to state that that would be exactly why they would not want to participate, again supporting the stereotyping of IT subjects as male dominated. One NZ male student thought that IS would be a great job for women as they could work from home and go part time if they had families He also felt that women probably made better managers where men concentrated more on the 'computer stuff'. This is an illustrative example of a male student also having problems identifying IT careers without preconceptions and tending to adopt stereotyping as reality.

Another recurring theme was how 'boring' IS was at school and how the women particularly, though not exclusively, had few good things to say about the subject as taught in schools. This echoes the findings of a government conference in NZ where the school IT curriculum was castigated by academics as failing to inspire pupils (Hendery, 2006). This is of concern for IS academics who must address students who have preconceptions of the subject as boring before they enter the lecture rooms. When initiatives such as WINIT (Griffiths & Moore, 2006) and ITBeat (Lee, 2005) were discussed with students there was great enthusiasm for the idea that technology could be made relevant to women.

Although the focus groups and interviews were conducted in an attempt to understand the issues for women and IS, they did have the bonus benefit of actually helping to educate the students about the role of the IS professional. In spite of these issues being talked about at length in the lectures, it was not until the students had to think about themselves that they could see that there were some possibilities. When asked if any of them had changed their minds about undertaking an IS major, three students said they would consider it when they received their exam results – unfortunately, none of the three were women.

OUTCOMES FOR COURSE DEVELOPMENT

Although women leaving the IS profession is a difficult issues for academics to address, the many women entering tertiary education that are exposed to Information Systems as part of their university course are our concern. These courses are an opportunity to highlight many of the positives of undertaking Information Systems as a career. However, it is often at this point that we, the academics, fail to inspire these women to continue with IS studies. We found from our data analysis that a key point raised by the female students was the need to make the course relevant to them. These students had more difficulty relating to the course content in the abstract, but responded well to guest lecturers who presented real situations such as how information systems were implemented and where and why projects had failed. This appeared to be particularly important where the students had little personal contact with people who worked in any IT-related profession. Guest lecturers from industry also help to overcome some problems related to role models and enforce the lectures that emphasise the 'people' nature of IS as a career.

One of the issues is that women enjoy connected knowing or learning, as opposed to separated learning, and therefore are often good at working in teams (Morris, 2002). However, many of them find groupwork in university to be a frustrating experience as often the effort expended varies between students. This is a dilemma in a large group of first year students, where interests and skills vary. More use of online collaborative learning both peer to peer and student to lecturer is likely to encourage women who are more attuned to cooperative learning styles (Rajagopal & Bojin, 2003). The use of chat-room discussions and promoting group learning through discussions and emails appears to appeal to women in a learning environment (Rajagopal & Bojin, 2003). Greater application of such methods to IS courses would greatly benefit them and improve study methods.

There is also a need to relate concepts to the personal experience of students using an active hands-on approach. We have found that case studies to which the students can relate increases interest and promotes questioning. Case studies from the text books are not seen as 'real' and time taken to develop more 'live' material produces a better response. This is particularly true when case studies have a social element to which the students can directly relate (for example, health, non-profit and female orientated cases).

One of the outcomes at the Australian University is a complete rewrite of the undergraduate degree. Part of the rewrite involves the introduction of four units based on integrated studies. These four units are taught outside of the normal school or department disciplines and involve staff from throughout the faculty teaching communications, numeracy, ethics, problem solving, negotiation, teamwork and information literacy through integrated activities. It is hoped that the women will enjoy learning about information systems in the context of information literacy, and will utilise computers for a variety of purposes such as research, reports and presentations, interpreting data and creating graphs. The students will also be creating e-portfolios and gaining career advice as part of one of the units, and there will be a strong push to expose them equally to all the disciplines offered by the faculty. The new subset of units will also involve industry and employers, and there will be a series of lectures and networking opportunities for the students. Several women Chief Information Officers have been identified as being important for this part of the program, and it is hoped that they will be able to inspire more female students to join the profession. This is in line with the proposed action in the Business/Higher Education Round Table report (BHERT, 2005).

In the NZ University, the approach to date has been more low key. Information Systems sits in the Science Faculty, which raises barriers in the minds of our business students despite the introduction of a joint business/IS major. The discipline has developed along more technical lines over the years than many other IS departments due to its co-location with other IT related disciplines. To counteract this we have recently identified and promoted a business pathway through the degree programme to enable students to choose the emphasis of their IS degree. The first year course has two academics appointed to reform the content over a period of three years to make it more accessible and relevant to the students from other disciplines as well as IS students. Interactive, visual teaching aids are being developed to present technical concepts (for example hardware and software) to the students and plans are underway to encourage third year and postgraduate projects to develop multimedia learning programmes for first year students. Outside guest lecturers, although difficult to find, have been used to great effect and other lecturers from within the discipline group have also contributed lectures on their research areas. This approach has been very well received by students who have been able to relate IS to the 'real world' and is to be continued.

RECOMMENDATIONS FOR MARKETING IS COURSES

Marketing is of paramount importance in attracting women into IS courses. The influence of parents should not be overlooked (Morris, 2002) and therefore there is a need to target parents at open days and encourage families

to IS display. The Australian university is creating a set of materials that will provide prospective students with better publicity about information systems and more enjoyable experiences through interactive displays. The New Zealand university has revised its promotion of IS courses to emphasise the 'business pathway' through the courses offered. It has also taken more control of planning for open days (previously left to the university administrators) and gained a role in both the Science and Business Faculties parents' evenings. Marketing events now emphasise the 'people, technology, information' definition of information systems. It is intended that such initiatives should overcome the 'geek' image problem expressed by the students in the study, and have a more positive influence on prospective students before they enrol.

Further marketing initiatives need to be encouraged at school level. The Women in ICT Task Force Report (BHERT, 2005) highlights the fact that in order to attract women into the computer-related professions, 'educators need to broaden the meaning and improve the values associated with the computer *per se* as a tool for productive and creative technological work across the life-career stages' (p.26). This report also identified the lack of women role models in the media; for example, there are no female IT professionals in sitcoms. In order to attract younger women into IT courses, career development officers and teachers in schools should be targeted, as there is no doubt that these people do make a difference to subject selection and impression about subject disciplines.

Finally, on a more general note, we have found that university marketing personnel often have little idea of what information systems courses entail and therefore do not highlight these courses to schools. More interaction with university marketing departments by IT academics is a necessary step to improving enrolments of either gender.

CONCLUSIONS

Employment in information systems around the world appears to be highly gender segregated, both horizontally and vertically, reflecting well entrenched ideas about the culture of computing. This is reflected in the lack of uptake of IT degrees by women and requires to be addressed in a number of ways.

Both universities in this study suffer from an imbalance between male and female IS academics. The whole discipline of Information Systems needs to encourage the appointment of more female role models. The need for more women academics is impacted by a shortage of women graduates and this "catch 22" situation needs to be addressed urgently if we are to encourage more women into IS degrees.

From a strategic perspective a reworking of the curriculum at both secondary and tertiary levels would be of benefit to improve the content of such courses and make them more personally relevant to women and their careers. From an academic perspective, course content and delivery must be improved and more closely related to business issues and the effect of IT on people and their lives.

Most importantly, the fact that women are unaware of exactly what information systems is, its relevance to people and its importance to business organisations must be addressed. Academics must step outside their teaching role and take a hands-on approach to addressing the drab image of the IT professions. They need to ensure that marketing of their courses informs prospective students, their parents and careers advisors of the true nature, content and value of information technology degrees.

FURTHER RESEARCH

This research has only addressed the presentation and content of introductory IS courses. More research into the progress of students through IS courses would contribute to a clearer picture how to not only encourage but also retain students, both male and female.

The dominance of male characteristics in system design, human/computer interaction and programming needs to be more clearly addressed at university level, together with developing an emphasis on usability that is more appealing to women.

Specific research on how to teach women so that the discipline appeals to them should continue to be conducted. There is a scarcity of literature, although there are now several academics actively conducting research in this area. A review of a similar problem within the sciences highlights the fact that such research has been happening in the pure sciences for a long time and has salient lessons for the information systems discipline.

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