CONCEPTUALISING GENDER AND IT:

AUSTRALIANS TAKING ACTION IN GERMANY

Liisa von Hellens
School of Information and Communication Technology,
Griffith University, Australia
l.vonhellens@griffith.edu.au

Sue Nielsen
School of Information and Communication Technology,
Griffith University, Australia
s.nielsen@griffith.edu.au

Kaylene Clayton
School of Information and Communication Technology,
Griffith University, Australia
k.clayton@griffith.edu.au

Jenine Beekhuyzen
School of Information and Communication Technology,
Griffith University, Australia
j.beekhuyzen@griffith.edu.au

Abstract

Presented in this paper are the results of an intervention strategy aimed at increasing the awareness of the gender imbalance in information and communication technology (ICT) education and work. It discusses an intervention, an undergraduate course on gender and ICT, which took place in Hanover Germany in February 2007. The intervention was based on research carried out by the authors as part of the Griffith University Women in Information Technology (WinIT) research project, which has been studying the problem of low female participation since 1995. The WinIT group has identified the following issues, which complicate research and action in this area. These issues frame the paper's results. The lack of agreement over what constitutes the Information Technology (IT) industry makes it difficult to assess progress in equity. The notion of female 'contribution' and the masculinsation of the IT industry are subject to competing definitions and viewpoints, indicating that there is no consensus on the aims or rationale for research and intervention in this area. The students' participation and assignments demonstrated increased understanding of these issues in IT work and education contexts. Overall, the students found the course helpful in overturning their assumptions about gender and IT and enabling them to acquire relevant problem solving strategies for preventing and handling gender related problems.

Keywords: IT education, gender, action research, qualitative, intervention, Australia, Germany

Introduction

This paper presents the results of an intervention strategy aimed at increasing the awareness of the gender imbalance in information and communication technology (ICT) education and work. It discusses the content and delivery of the intervention, which took place in Hanover Germany in February 2007. It focuses on that aspect of the intervention which dealt with how gender and information technology (IT) are conceptualized; that is how gender is differentiated qualitatively and how this differentiation relates to notions of IT. The paper discusses how the participants' ideas about gender and IT developed. Future papers will discuss this in relation to research carried out in Australia and other countries.

The intervention was to develop and deliver an undergraduate course on gender and ICT in Hanover Germany. A guest professorship at the University of Applied Science and Arts funded by the Maria-Goeppert-Mayer-Programme for International Gender Research enabled the authors to develop and deliver the course as well as to carry out research on the course's implications for changing perceptions and attitudes on female participation in ICT education and work.

The funding body especially welcomes teaching that focuses on those disciplines, which are particularly deficient in the area of women's and gender studies. The gender and ICT course fits well the aims of Maria-Goeppert-Mayer-Programme. The continuous under-representation of women in IT university programs and work is not only a complex social problem with serious economic implications for an important industry sector but also women studies, even though the focus is on the problems of ICT work and study issues is not regarded as mainstream research in IT academia.

Labor statistics confirm the continuing gender imbalance in IT education and work. For example, CIO Insight cites research by the Bureau of Labor Statistics that shows that employment of women in a broad range of IT positions has declined in relative and absolute terms over the past several years. Some 984,000 women worked in eight IT categories in 2000, accounting for 28.9 percent of all employed IT workers. The corresponding numbers for 2006, when overall IT employment hit an all-time high of nearly 3.47 million, show a 7.7 percent drop from 2000, with 908,000 women working in IT, or just 26.2 percent of the total. (Cone, 2007)

In our previous work we have explored the many strategies that are in place in Australia to reverse the trend of lack of female participation in this important area; and we have acknowledged that to date there has been little evidence of their success. This paper presents a new strategy, that of an undergraduate university course on this very topic. The course discussed here is novel; to our knowledge there exists no other undergraduate course, which has the same structure, length, audience and focus as this. Thus its novelty adds to the diverse nature of approaches, and gives an interesting insight into students' conceptualization of gender issues in information technology.

Several issues complicate research and action in this area. These are the lack of agreement over what constitutes the IT industry makes it difficult to assess progress in equity. The notion of female 'contribution' and the masculinsation of the IT industry are subject to competing definitions and viewpoints, indicating that there is no consensus on the aims or rationale for research and intervention in this area. However, although these problems and the lack of consensus may be considered inhibiting, the diversity of approaches may be best suited to a rapidly changing and dynamic industry; hence the interest in intervention programs as well as the continuing effort to theorise in this new field.

Background

Information technology (IT) work and education was originally thought of as a 'level playing field' where gender would be irrelevant, allowing flexibility in time and space. However, female participation in IT work and education has declined in the last few decades and IT has problems in terms of discrimination, lack of 'family friendliness' and work intensification.(von Hellens and Nielsen, 2001) With the overall increase of female participation in the workplace and the requirement in most countries to eliminate discrimination, harassment and other unfair work practices, the issue of gender remains a problem for IT education and work.

Information Technologies are an accepted part of everyday life. Most current school children do not know a life without IT as they have been integrated into all aspects of their life including home (e.g. watching a DVD), school (e.g. playing educational computer games) and personal life (e.g. talking to friends on a mobile phone). However, the vast acceptance and integration of IT into society has generally not translated into a desire to create new technologies and be involved in the IT industry. Researchers have shown that the number of students choosing to undertake specialised studies in IT is not growing at the same rate as with other degree or study

programs (Beekhuyzen, Nielsen and von Hellens, 2003). There are many factors that contribute to this declining interest in IT educational and vocational pathways including cultural, social, structural and individual factors (Adya and Kaiser, 2006).

Cultural influence shapes perceptions about IT and how it is used (Harris and Wilkinson, 2004). IT is commonly stereotyped as a masculine domain and society has perpetuated the myth that subjects such as mathematics, science and computing are inappropriate for girls, even when they have shown exceptional aptitude for these subjects (Camp, 1997). These beliefs can be shared and spread amongst family, friends and teachers (Camp, 1997). Considerable evidence also points to the content and delivery of the secondary IT curriculum being an important factor in interesting students in IT careers (Newmarch, Taylor-Steele and Cumpston, 2000). Students frequently complain that IT subjects are boring and Newmarch et al. (2000) believe that this could be due to the focus on mastering software packages and the perception that IT is simply word processing. Students are also being taught by teachers possessing a disparate range of IT skills partially due to the level of exposure the teachers have received in their pre-service education and professional development along with their access to technology (Goldman, 2003). The lack of or poor quality IT information at school leads to poor perceptions of IT and consequently low IT enrolments and teachers need assistance to help them remain current in curriculum, industry and IT career information (Clayton, 2004).

It is also important to consider individual factors, such as personality traits and intellectual qualities, (Trauth, 2002). These individual factors and the way that the student interprets the cultural, social and structural factors are all important influences on whether the student chooses to become involved in IT educational and vocational paths. The problem of declining interest in the IT field is a complex issue and cannot be attributed to any of these factors in isolation. It is the understanding of relationships and the interaction of all these factors that holds the key to addressing the declining interest in IT educational and vocational paths.

The problem of declining female participation in IT education and work is two fold. Firstly, women are not encouraged to study information technology for a variety of reasons; and secondly, the information technology profession not well understood (ideas of working long hours, sitting alone in front of a computer with little social interaction) and thus is generally regarded as boring by young people, male and female. These two aspects are related but in this paper we focus on the former, i.e. the problems females face in the IT field of study and work.

Since 1995, the WinIT project has investigated female attitudes to IT and participation in IT education and work at three levels: high school, university and industry (http://www.cit.gu.edu.au/~jenine/WinITProject/). The most relevant results are briefly outlined in the following sections. Early research into high school students attitudes and the barriers and problems encountered by female university students led us to investigate the factors which influence women to enter and remain in IT professional level work. A natural consequence of this developing stream of research was to consider the influence which successful women might have on students facing education and career choices. Therefore in 2000 the WinIT project moved from research to action by initiating a high school mentoring project. Since then, two of the authors have been involved in other mentoring programs but to date we have lacked the resources to deeply analyse the outcomes of these programs. Running programs usually attracts funding more readily than program evaluation. However, the lack of evaluation makes it hard to consolidate experience and correct mistakes, and the intervention programs are viewed by some as "under funded, fragmented and marginalized" (Walters, 2006, p.26).

The WinIT research program views female participation broadly as including women's utilisation of IT and their contribution to the IT industry and IT products. In our previous paper (Beekhyuzen, Nielsen and von Hellens, 2006) we focused on the recruitment of women and the retention and progress of women with professional level IT education. In this paper, we attempt to clarify how a group of IT students conceptualise the notions of IT and gender, and how a course devoted to awareness raising may modify and extend these notions.

In reflecting on research and intervention in this area we have become aware of three main issues:

- The problem of equity (fairness and equal rights) and the implications for women's careers and status in the work force; equity may be considered horizontally (participation) and vertically (status), but in both dimensions women are clearly under represented in the IT industry. However, understanding this inequity is complicated by the lack of definition of the IT industry – exactly what women should be participating *in*.

- The notion of the 'contribution' of women to the design and construction as well as the utilisation of IT, both currently and in the future. This involves two contentious ideas; firstly that women have special skills or attributes that they might bring to the industry; secondly, that female participation in the IT industry may result in meeting different, female needs.

- The masculinisation of IT; that is, the 'gendering' of an economically important and socially significant industry. This doesn't imply that masculinsation makes the IT industry more appealing to men. In fact, it may be the reason associated with the overall decline (female and male) in interest in IT careers. The definition of gender and IT is also a complex issue that varies amongst different social groups and is subject to change.

If we reflect on these issues, we can see immediate problems with carrying out research and intervention in this area. This has led the WinIT group to move towards action research, to take into account the changing social construction of concepts such as equity, gender and IT. Such research needs to be reflexive; to be critically aware of the influence of participants and researchers. Future papers will discuss this further. In this paper we focus on how the students' perceptions of gender and IT developed during this course, and what this tells us about the complex notions of equity, masculinisation and contribution.

In order to introduce an intervention and investigate the way that these issues are conceptualized by those involved in working in the industry (or to be soon), we have developed a flexible set of courses which could be used essentially as training courses to 'raise awareness' and give participants opportunities to practice specific decision making and conflict management skills. They could also be used as extended courses designed as 'elective' programmes, allowing undergraduate or postgraduate students to complete assessment and gain credit points towards degrees and diplomas.

Presented here in this paper is our first attempt to introduce the intervention as an elective undergraduate course for computer science and business students. This course is described in the section Gender and ICT Course Content, Audience, and Delivery of this paper.

The intervention has allowed the authors not only to reflect on their own research on gender and information technology but also explore how a group of IT students conceptualise the notions of IT and gender, and how a course devoted to awareness raising may modify and extend these notions. An improved understanding of this conceptualization will guide future interventions in this problem area.

Method of Research

As mentioned above the authors were invited to develop and deliver a gender and IT course to the undergraduate students from the information technology faculty and students majoring in information systems from the faculty of business. Both faculties lacked female staff and students and regarded it as problem, thus the initiative to offer an elective course on this topic to undergraduate students.

Developing and running the course resembles *action research*, as the researcher is also a change agent. Action research involves planning, action and review. Technically action research may be defined as a cyclical reflective process containing research methodologies that allow dual outcomes of action and research (see the reference to Dick, 2002, p159 and to http://www.scu.edu.au/schools/gcm/ar/arp/arphome.html in McMurray, Pace ands Scott, 2004, p277). This course is also an illustration of *action learning*, a process, in which a group of students help each other to learn from their study experience facilitated by the instructors, the authors of this paper.

Running the undergraduate course on gender and IT is an activity at the second stage of the action research process, the 'therapeutic stage' involving a collaborative change experiment of action research/action learning process. In the therapeutic stage changes are introduced and the effects are studied. The preceding first stage of action research is the 'diagnostic stage', a collaborative analysis of the social situation by the researchers and the subjects of the research.(Blum, 1955 as cited in Baskerville, 1999)

The growing body of literature on gender and IT including the authors' research (WinIT project) is an illustration of the diagnostic stage of action research in this area. Examples include collections such as the Encyclopedia of Gender and Information Technology (Trauth, 2006) containing peer-reviewed research reports from 295 international specialists/researchers. The encyclopedia also includes over 4,700 references to additional works on gender and information technology in order to stimulate further research and is an objective proof that there is a problem. The reasons to promote women's participation in IT range from ethical to economic but researchers acknowledge that the extensive effort to promote women's participation have not worked as pointed out by McGrath Cohoon and Aspray (2006, viii). They suggest "the issue is so complex making it difficult to know how to go about reaching gender balance in IT."

Our objective was to change the participating students' perceptions of gender and ICT and improve their competence in developing strategies to avoid gender-based problem in IT study and work situations. During the teaching course we collected and reviewed the participating students' opinions about gender aspects of IT

education and work to explore their attitudes before and after the course. Our research was covered by the university's human research ethics approval. This paper is the first of series of papers that describe and evaluate the effectiveness of our intervention. This paper also represents the reflection on the conduct of the action research project and discusses its effectiveness in enhancing the actors' ability to address the gender-based problems of IT.

Ten students attended the course. Six were students majoring in IT in the business faculty and four were from the computer science faculty. The course was an elective course they were able to do in a block mode during the semester break.

The data collected crossed all aspects of teaching; class discussions and students assignments were used for this research. Additional data was collected through a series of open ended questionnaires on the subjects views on gender an IT as well as their opinions about various teaching methods.

Gender and ICT Course Content, Audience and Delivery

Content

We chose teaching and assessment methods that included scenario analysis, research methods, teamwork, and analytical reports to help student develop the following attitudes (1), knowledge (2 and 3) and skills (4).

(1) A wider appreciation of the different stakeholders' views of systems development and use, and of gender and IT;
(2) An understanding of the ethical, equity and commercial implications of the gender and IT problem.
(3) An understanding of variety of ways of increasing participation and success of females in the IT education and work.
(4) Abilities to analyse and propose solutions to gender and IT based problems by using a scenario-based problem solving method.

A problem solving method for ethical decision-making was applied by refocusing from ethical issues to gender issues. The problem solving method was applied to a range of scenarios illustrating specific gender-based problems in IT education and work situations.

The scenarios were based on real life situations. Participants in the situations, including past students, research subjects and collaborators as well as colleagues from academia and industry, provided the information. Further information was added to provide contextual realism. It is acknowledged that different participants might view these situations differently. However, the authors did not make judgments on the participants' accounts. Scenarios were selected because of the complexity of the issues. We also avoided using simplistic scenarios, which would give the students very little to work on.

In its initial delivery in February 2007, the Gender and ICT course aimed to introduce German undergraduate students to the major research perspectives in gender and IT, including essentialism, social construction and individual differences. In doing so, the students (in groups of two) explored the major issues that inhibit or facilitate female participation in IT education, work and use. These included issues such as the masculinisation of the industry and education, role models, culture and work intensification. The major issues identified were also discussed in relation to various age groups, cultures and work settings.

Further, the course encouraged students to research and apply success strategies that improve female participation and success in IT education and work including intervention, mentoring, industry and government and educational initiatives. This course also worked towards helping develop a number of graduate skills also, such as effective communication (oral, written, interpersonal), information literacy, problem solving, critical evaluation, work in teams and ethical behaviour in social/professional/work environments. The course included the following components.

- Introduce participants to the 'gendering' of IT

- Discuss the status of current research

- Explore the current situation and causes of declining female participation in IT education and work, in terms of recruitment, retention and progress

- Identify potential solutions to the problems in IT education and in the workplace

- ▪ Provide skills in ethical analysis and decision-making, and conflict management to assist participants to resolve problems and to contribute to improving the situation.

Audience

Translated into English, the Fachhochschule is promoted as a University of Applied Sciences. Within this specific educational context, students are generally older than mainstream university undergraduates and have at least some industry work experience. In our course the student group had ten students: made up of nine males with German heritage and one female with a Russian background. All students were between 22 and 29 years old and did have some degree of work experience before commencing study at the Fachhochschule. They were at varying stages in their undergraduate degrees in computer science and business administration.

All students spoke good English, with some students better than others after spending some time studying abroad. As well as English skills, some of our students also spoke French, Russian and Swedish.

Eight out of the ten students indicated that interesting work was more important in their working career than a high salary. This is also consistent with the preliminary findings of our survey of 150 German secondary school students (conducted alongside this study). The same eight students indicated that working with interesting people was more important than a high salary.

All students had worked in a group previous to this course, realising benefits of "sharing different points of view", "sharing knowledge", "learning more", "funnier", "healthy competition" and "the team members can help and motivate each other". Some disadvantages of working in groups included "endless discussions about things of minor importance", "not everybody is reliable" and "sometimes not all want to reach the goal with the same working philosophy".

The students had a range of goals when commencing this course, from "defining their place in the IT work (world)", to "getting a broader view and self impression of female view on IT" and even "improving my English". Mostly students wanted to be more informed about the problems facing females in IT and learn how to increase the number of women in IT. It was unclear exactly what the students knew about the issues of gender and IT before faced with the option to take the course, but we can assume they were informed enough to know there *is* an issue if they decided to take the course.

Students' initial attitudes were determined via surveys and exercises carried out at the beginning of the course. Even though the students were skeptical that gender equity was a problem in Germany, they expressed conventional and traditional views of the gendering of IT. Men see IT as interesting and challenging in itself, whereas women like IT "only if it has an obvious use for them." IT is perhaps "too difficult or boring", for women who are "more communicative", and men and women have "different experience" with IT.

Delivery

The course was delivered over a 12-day period (Monday to following Friday) in the university winter break from regular classes, with classes on campus from Monday to Friday from 9am to 3pm. In assessing the students, they formed groups of 2 (5 groups in total) and worked on a case study analysis report, which culminated in doing a presentation on their report to the class and the local professors (2) of the computer science and business degree programmes.

We framed the fictional case studies we developed as scenarios of a study/work situation as discussed above. They were all based on real-life accounts and expanded with incidents from the gender and IT research literature. In some cases we made a deliberate effort to disguise the gender problems that were too obvious by changing the biological gender of the people associated with the main protagonist. We also added material typical of the various organisational or institutional contexts, for example to reflect the complexity of running a small business. These changes situated the gender issues within specific contexts.

The students were required to reference contemporary gender and IT literature, the local legislation on equity as well as the tools for ethical decision-making and conflict management presented in the course. A written report of the groups' scenario analysis was due four weeks after the presentation. The students' written reports were expected to incorporate the feedback from their presentation.

Each case study (scenario) was a description of a situation in IT education or industry (software development, use of IT resource, IT workforce management), which included a gender related problem that was discussed in the lectures. Students therefore were able to apply the general concepts discussed in class to their particular scenario. The aim of the exercise was for students to analyse the situation and suggests a relevant solution. They

then had the opportunity to present their case study and their solution and analyses to the rest of the group and teaching team including relevant staff at the university. The presentations lasted for 20 minutes with 15 minutes for discussion.

The students were encouraged to provide solutions to the problem situation presented in the scenario. The solutions were expected to be applicable in the students' study and work environment and in alignment with the local legislation. In addition to the gender and ICT literature two theoretical frameworks were introduced to further assist in analyzing the scenario. The first was Bommer's model for analyzing ethical dilemmas in a complex situation. (Bommer, Gratto, Gravender, and Tuttle, 1987) This model is a practical method for reducing complexity to its components and would help the student discover issues that were affecting the behavior of the characters in the scenario. These issues provided useful information to the students for considering/formulating a solution to the problem situation.

The second theory that was introduced to guide the students' analyses was Thomas and Kilman's (1974) conflict management framework. The students were advised to adopt a gender perspective when analyzing the conflict management strategies and when recommending a solution to the problem situation in the scenario. Valentine (2001) has applied the Thomas-Kilman model to analyse gender perspectives on conflict management strategies of nurses. These two theories are summaries in Appendix 2.

The students were then introduced to the main theories on gender and IT, referencing works by well-known researchers in this area from US, Europe and Australia, including the authors.

The five scenarios given to the students:

- "Sarah goes to Secondary School" is a scenario that describes a female student observing unethical behaviour of a fellow student and the teacher.

- "Donna in University" describes a female student in a male dominated programming course.

- "Louisa is a Postgraduate Student" struggling in a male dominated group of male postgraduate students in an IT faculty.

- "Kathryn's Software Team Lunch" describes a work situation involving sexual harassment toward a young female IT consultant.

- "Alicia works for Small IT Business" discusses the range of problems of managing a small IT consulting firm.

The students were required to analyse the problem situation by using tools that were provided and to provide a solution that would stop a similar problem situation from happening in the future. An example scenario is (Kathryn's Software Team Business Lunch) can be found in Appendix 1.

Findings

Students' Performance Assessment

All students made an effort to analyse their scenarios demonstrating an interest in and an understanding of the course topic. Referencing the course literature was not as extensive as we had hoped; maybe the lack of time to peruse the course readings prior to the course commencing had some influence on this. All groups had included in their written report a workbook (work record) and a document history they had complied. All groups recommended solutions that were meaningful; some of them were quite innovative and insightful as well as being well grounded in the theory and practice of gender and IT, while some other solutions required further development. All groups completed peer reviews; they were graded on pass (report submitted 10 marks) or failure (peer review not submitted, 0 marks). Peer review content was not used for assessment of an individual group's presentation but was used to make sure everyone attended fellow students' presentations and participated in the discussion by asking questions and sharing their insights. Only the teaching team assessed the groups' presentations.

In general, the teaching team was very impressed with the students' work; in a relatively short period of time they were able to demonstrate an understanding of the topic of a complex social problem that was relatively new to all of them. Their oral presentation skills were impressive; talks were well structured, demonstrating maturity and a good understanding of oral communication and what is required for a good presentation. The fellow students also participated actively in the discussion by providing further comments and insights.

Conceptualising Gender and IT

The course invited the students to consider gender and IT and the relationship between them as problematic. In addition the students were required to use a number of frameworks as a basis for their analysis of the scenarios. This inevitably constrained their analysis but was necessary for the students to undertake assessed work. The three main frameworks were; notions of gender, drawn primarily from research in this area, an ethical decision making framework (Bommer et al, 1987) which allowed students to think about the contextual issues, such as the woman's background and the code of conduct espoused by the organization, and lastly a conflict management framework (Valentine, 2001) which helped identify assumptions about how women are expected to behave in similar situations. These frameworks are summarized in appendices. To a lesser degree we also introduced students to the notion of 'group think', which reinforces stereotypes and makes it difficult for participants to understand how their behaviour may be discriminatory.

We refer to the scenarios described briefly above by the name of the key person in the scenarios - Sarah, Donna, Louisa, Kathryn, and Alicia. Each scenario was given to a pair of students who were expected to analyse them by using the tools provided and by referencing the gender and IT material provided in the course. Kathryn's scenario is provided in full in Appendix 1.

The students were invited to think about gender differentiation according to a number of qualities: roles (mother, father, etc), attributes (modesty, courage, strength, etc), behaviour (cautious, reckless, etc), aspirations, values, relationships, social relationships and conventions. IT was considered via conventional views such as elements (hardware , software, etc) and purposes and the dichotomy between social and technical views of IT; that is social systems technically implemented or technical systems with social implications. The 'gendering' of IT was explored via three different research perspectives; the essentialist view which accounts for gendered differences in aptitude with and attitude to IT, the social construction approach which holds that gendered differences are created through cultural and social traditions, which the WinIT group utilizes, and the more recent individual differences view which focuses on the influence of factors on individuals by Eileen Trauth (2002).

As mentioned earlier in this paper the student surveys at the beginning of the course confirmed conventional and traditional views of the gendering of IT. However, their attitudes and conceptions changed through the process of completing the scenario assignment. These are discussed under the headings of the three main issues equity, contribution and maculinisation of the IT field of study and work.

Equity

Each of the five scenarios is based on the experiences of individual women IT professionals or IT students. As such the participation issue is immediately evident in the lack of female colleagues or fellow students. However the German students were asked to analyse how this might affect equity.

The students initially were dubious that equity was a problem in Germany or that any of the dilemmas and issues presented in the scenarios were likely to occur there. Students referred to the traditions of fairness and equal rights, regardless of differences between individuals or classes of people.

However, the class was required to investigate the situation in Germany and this provided a major change in attitude as students found statistics to show that discrimination and harassment are serious problems in Germany in non-traditional work areas. Students also found local examples on their faculty notice boards eg a recruitment poster from a local engineering company presented a man with his head directly in line with a woman's breasts as the main message. The scenario descriptions and the frameworks for analysis were designed to enable the students to understand the potential causes of these problems.

The analysis by Donna's group enabled them to see how being a member of a minority group (females in an IT faculty) resulted in identification as 'different' and this resulted in Donna being treated unfairly. The behaviour of Donna's female lecturer also was judged to result from inequity, in that she had had to adopt a 'male' persona in order to succeed in the primarily male IT faculty.

Contribution

Attitudes towards female contribution were mainly investigated through the use of the Thomas-Kilman conflict management model. The authors have used this model in undergraduate course and found it useful for helping students understand the conflicts between IT stakeholders and how these conflicts may be managed.

Donna's group found that as an undergraduate student, Donna was accustomed to acting in a collaborative manner with her fellow male students but was unable to resolve her conflict with her lecturer this way. Because of the unequal power relationship and the female lecturer's attitude, she adopted avoiding tactics.

In contrast, Kathryn's group identified her behaviour as 'avoiding' both in this problem situation and in a past event and this contributed to the escalation of the situation. Similarly, Louisa's group found her defensive, 'avoiding' behaviour, allowed her male colleagues to continue their behaviour without examining it. In both cases, isolation and the lack of a strong mentor made it difficult for these women to confront the source of the problem or to collaborate with the participants to seek a solution.

The high school student Sarah also showed a 'strong tendency to avoiding the situation' claimed the group which analysed the scenario. This was reinforced by the teacher's behaviour who took no account of her interests and who himself avoided tackling behaviour problems in his class. This is despite a strong tradition in modern Australian education, which invites student participation in classroom decision-making. The IT curriculum that Sarah undertook was expressed in terms of male interests (an assignment based on football) and did not take account of her interests or knowledge.

There has been no research carried out using this model to investigate how women in IT handle conflict. However a study of nursing staff found that two conflict management strategies, avoiding and compromising, were used predominantly by all categories of nurses. Valentine (1987) also commented on reasons why the remaining three strategies (collaborating, accommodating, competing) were used only infrequently. The power differential that separates nurses and other health care workers may be a reason for not using collaboration.

In the case of nurses a traditional and rigid hierarchy supports the power differential. In the scenarios presented here, the power differential varied from the legitimate teacher/student relationship to more informal power differentials supported by cultural norms (such as typical male behaviour).

The difficulty relinquishing issues, recognising legitimate exceptions to rules, forming good intentions or admitting one is wrong may stop nurses adopting the accommodating strategy. Nurses may avoid competing because of the difficulty in taking a firm stand on issues, perhaps because of lack of awareness of power and skills or discomfort in using them. The WinIT group has challenged the notion that women bring 'special female skills' particularly communication skills to the male dominated IT workplace.

Similarly there was little evidence in the IT scenarios of competing behaviour. This may be for the same reasons as was found in the nursing study; the difficulty in taking a firm stand. However the cause of their behaviour differs. There is no tradition in IT of putting others' concerns ahead of their own, as there is nursing. Instead, the lack of competitive strategies possibly results from lack of opportunity to practice assertive behaviour in a male dominated environment. In this regard, role models and mentors would be useful.

The tendency of women in these scenarios to use avoidance in conflict management reinforces 'group think' allowing the majority of their male colleagues to continue their behaviour unchallenged.

Masculinisation of IT

Donna's group became aware that despite the tradition of European enlightenment which emphasized individual freedom, and the requirement of the university for gender equity, the culture in the IT faculty is dominated by 'technophile' men and this homogenous culture affects the way these ideas are enacted, even by female lecturers within the school who have had to adapt to this culture.

Kathryn's group identified this as a particular problem for young women who may need to leave friends and family to take up graduate positions. The masculine environment makes it difficult for these women to seek advice. This is similar to the findings of the WinIT research that identified the inability of women in IT to join in masculine pastimes (sports, social events) as a major problem in networking and advancement.

Sarah's group referred to the masculinisation of the entire school system (with the exception of more innovative approaches in primary education, such as the Steiner approach), which intensifies in high school. This downplays skills, which would be useful in conflict management and makes it difficult for Sarah to express her dissatisfaction with the behaviour of her teacher and fellow students. This group contradicted the notion that women can or should bring 'female' skills to IT and argued that these skills, such as team work, collaboration and communication should be developed in all students, since they are increasingly important in the work place.

Louisa's problem was also viewed as arising from a lack of sensitivity in the work place to the problems that an individual female student might have, in a badly organized workspace and without some support from a university equity officer.

The students generally presented quite sophisticated notions of gender, sometimes challenging the traditional views. Donna's group saw the discriminatory behavior of the female IT lecturer as pessimistically social constructionist. The lecturer saw herself as a "rare exception" to the patriarchal society, and this led to he wanting to retain this exceptional status by discouraging female students.

Overall the students saw the female students' and IT worker's problems as arising from a homogeneous culture, stereotyping and lack of organizational support or intervention. The education facilities and work environment mirrored the dominant culture.

Students' Views on Gender and ICT Course

The class surveys confirmed that the students recognised that this unique course provided them with a valuable opportunity to learn about the long-standing problem of under-representation of women in the IT workforce. At the start of the course, some of the students were convinced that there was not a problem with the involvement of women in the IT workforce, especially in Germany. One student admitted that the course was eye opening because "most of us were convinced [that] certain problems had no relevance in German work life." Other students agreed by saying that "I never really thought about it" and "the topic is a totally new concept for us" while another found the global context of the problem very interesting.

The transformation of student opinion was observed through the duration of the course and was confirmed in the evaluations. In these evaluations, most of the students commented about how the course raised their awareness of the problems that females face in the IT pipeline. One student stated in his evaluation that "the course showed us that there are problems for women [in the IT workforce]." The students were interested in how the work environment can have either a positive or negative impact on female IT work experiences and that it helped to see the IT workplace from the view of a woman.

Despite the challenges of the course not being delivered in their native language and the student's unfamiliarity with the complex issues covered in the course, the students were able to draw on their work/life experience to put the course material in context. There was evidence that the course had influenced the student's intended behaviour in the IT workforce. One student commented that the course provided the tools required making problem solving in the IT workplace problems in the future easier. However, one student cautioned people about becoming too oversensitive to the problem and not being able to think and act in an objective manner in terms of the problem. Overall, the students seem to believe that they need to be sensitive to the female perspective in the IT workforce and avoid prejudices and clichés.

Discussion

The main conclusion of the students who analysed Donnas' and Kathryn's problem was that mentoring for Donna or gender awareness raising for the staff would have prevented the situation from arising. Louisa's group also saw the need for external intervention. Educating the students and teachers, and the provision of role models to provide guidance in more appropriate attitudes and behaviour could alleviate Sarah's problems at high school. All scenarios worked well, although Alicia's scenario was hardest to analyse because of the difficulty of separating gender issues from the challenges facing a small IT business manager in the competitive market place.

The students primarily viewed the behaviour of the male colleagues, students and teacher as arising from the context, reinforcing the notion of gender and IT as socially constructed. However, their analyses contradicted many of their previously held assumptions. Firstly, the notion that women are more communicative than men was shown to be unrealistic in situations where women were stereotyped and were unable to collaborate to resolve their difficulties. The women in these scenarios primarily avoided communicating about their difficulties and were unwilling to engage in debate about the issues they faced. The conventional wisdom that women can bring a special 'contribution' to IT work was overturned and the students concluded that the context needed to be supportive for women to express their full range of skills.

The scenarios were based on real life situations, and provided sufficient detail for the student to analyse the complexity of the context within which notions of gender and IT are constructed and enacted. Although the students found existing views on gender insufficient to explain what was going on, they developed a much more sophisticated appreciation of how gender discrimination may operate in IT education and the workplace.

Conclusion

This paper described and evaluated the effectiveness of an intervention, which is an undergraduate course on gender and IT to educate students in gender-related IT issues. Developing and running this undergraduate course resembles action research involving collaborative change experiment, called the 'therapeutic stage'. (Blum, 1955 as cited in Baskerville, 1999) and this paper illustrates the reflection of the action research project. The course's aim was to improve the students' understanding of the complex problem of declining participation of females in IT education and to provide problems solving skills for developing strategies to avoid the consequences of the unsatisfactory gender balance. As pointed out in the introduction section of this paper the labor statistics confirm the trend: the demand for IT skills continues to grow but fewer women are entering the IT education and many women are leaving the IT workforce. Negative implications of the trend include reduced opportunities for women in the workplace, decreasing innovation and competitiveness in technology and the economy at large; and confirm the significance of this research project.

Lack of females in IT is a complex social problem and all interested parties agree an effective intervention is required but agree there isn't a single, silver-bullet solution. This intervention has allowed the authors to reflect on their own research on gender and information technology and evaluate an intervention strategy at the undergraduate student level. The notion of female 'contribution' and the masculinisation of the IT industry are subject to competing definitions and viewpoints, indicating that there is no consensus on the aims or rationale for research and intervention in this area. However, although these problems and the lack of consensus may be considered inhibiting, a diversity of approaches may be best suited to a rapidly changing and dynamic industry.

Acknowledgements

References

Adya, M., and Kaiser, K. M. (2006) Factors Influencing Girls' Choice of Information Technology Careers. In E. M. Trauth (Ed.), Encyclopedia of Gender and Information Technology (Vol. 1, pp. 282-288). Hershey: Idea Group Reference.

Baskerville, R. L. (1999) Investigating Information Systems with Action Research, Tutorial. Communications of the AIS, Vol 2, Article 19, October 1999.

Beekhuyzen, J., Nielsen, S and von Hellens, L. (2006) Making IT Fit: Facing and changing reality in Queensland (2006) In Proceedings of AusWIT 2006: partICipaTion one year on, 10th Australian Women in IT Conference. Adelaide, 4-5 Dec 2007.

Beekhuyzen, J., Nielsen, S. H., and von Hellens, L. A. (2003) Challenging Dualisms in Female Perceptions of IT Work. Australian Journal of Information Systems, 10(2), 105-115.

Blum, F. (1955) Action research – A scientific approach? Philosophy of Science, (22) 1:1-7.

Bommer, M., Gratto, G., Gravender, J. and Tuttle, M. (1987) A Behavioural Model of Ethical and Unethical Decision Making, originally published in Journal of Business Ethics, 6: 265-280. Kluwer Academic Publishers.

Camp, T. (1997) The Incredible Shrinking Pipeline. Communications of the ACM, 40(10), 103-110.

Clayton, K. L. (2004) Information quality: The relationship to pre-tertiary IT education. Paper presented at the Informing Science and Information Technology Education Joint Conference, Rockhampton, Australia, 25-28 June 2004.

Cone, Edward (2007) Why Do Women Leave IT? CIO Insight No. 82, p24. ACM TechNews June 7, 2007. Url: http://www.cioinsight.com/article2/0,1397,2149170,00.asp. Date accessed: 7 June 2007.

Dick, B. (2002) Postgraduate programs using action research. The Learning organization, 9, (4), pp159-170.

Goldman, D. (2003) Reality Bytes: A reflection of the perception versus the reality of teaching with ICT. Paper presented at the IFIP Working Groups 3.1 and 3.3 Working conference: ICT and the Teacher of the Future, Melbourne Australia, January 2003.

Harris, R., and Wilkinson, M. A. (2004) Situating gender: students' perceptions of information work. Information Technology & People, 17(1), 71-86.

McMurray, A. J., Pace, R. W. and Scott, D. (2004) Research: a commonsense approach. Thomson Social Science Press.

McGrath Cohoon, J. and Aspray, W. (2006) Women and Information Technology, Research on Underrepresentation by McGarth and Aspray (Eds). MIT Press.

Meyer G. R. (2004) What is Action Research? In Clive (ed) Social Methods, London, Routledge, pp453-455.

Newmarch, E., Taylor-Steele, S., and Cumpston, A. (2000) Women in IT – What Are the Barriers? Network of Women in Further Education Conference Showcase of Strategies for Women in Education on Information Technology Conference. Retrieved from www.detya.gov.au/iae/analysis/womeninit.htm on 7 Apr 2003.

Thomas, K. and Kilman, R (1974) Thomas-Kilman conflict mode instrument. Tuxedo, N.Y., XICOM.

Trauth, E. M. (2006) Encyclopedia of Gender and Information Technology by Trauth (Ed). Idea Group Reference.

Trauth, E. M. (2002) Odd Girl Out: an individual differences perspective on women in the IT profession. Information Technology and People, 5(2), pp.98-118.

Valentine, P.E.B (2001) A Gender perspective on conflict management strategies of nurses. Journal of Nursing Scholarship, First Quarter, pp 69-74.

von Hellens, L., & Nielsen, S. (2001) Australian women in IT. Communications of the ACM 44(7), 46-52.

Walters, K. (2006) EXI.T. Business Review Weekly, July 27.

Appendix 1: Kathryn's Software Team Business Lunch.

Harrison Consulting, a global IT consulting company, is currently the prime contractor in charge of a large enterprise resource planning package implementation at the Australian Federal Department of Education in Canberra (the Australian capital). As a part of this effort, Harrison Consulting is comprised of a variety of functional and technical teams, who work hand-in-hand with education department domain experts and quality assurance personnel.

On this project, the Harrison Consulting software test team is comprised of a project manager and 4 consultants, three men who have been with Harrison Consulting for between 2 to 5 years and a young female consultant (Kathryn) who has just completed her Bachelor of IT degree. Kathryn has been with Harrison Consulting for six months and received excellent feedback on her first semi-annual performance review. This led to her placement with the software test team. She feels confident that Harrison Consulting will provide her with good career opportunities. She is happy that she made the decision to move from her home in Sydney, even though she misses her family and friends, and is even purchasing an apartment. The software test team is managed by a Harrison Consulting partner and project manager (Stephen). All software test team tasks and deliverables must be coordinated and approved by an external quality assurance management contractor (Doug).

Two months later*: After two months on the project, Kathryn begins to experience unsolicited sexual advances from Doug, a contractor (from outside) who is working for Harrison Consulting. Doug has made repeated sexual comments to Kathryn about her body, her clothing and his attraction to her. These advances have come in forms of both email communication and in face-to-face contact. Kathryn is very uncomfortable with the situation and feels stressed when she must interface with Doug. She does not understand Doug's behaviour as she believes she has done nothing to encourage his advances. As a result she does not know how to cope with his harassment. An older female colleague (June) whom she occasionally joins for lunch, advises her to ignore Doug and not make a fuss.*

One day Doug invites Kathryn to a "software test team business lunch" and explains that the team will meet in the lobby at noon. When Kathryn arrives, Doug is the only person there and tells her no one else wanted to join them. Kathryn is uncomfortable, but feels she is unable to back out of lunch at that point. On the way to lunch Doug insists on driving, he also opens and shuts Kathryn's car door for her and pays for lunch at a quiet café. Kathryn is aware that government regulations applying to this project prohibit financial gifts, including meals, in contractor-client relationships. Harrison Consulting also has a policy that prohibits romantic contractor-client relationships, although there are a number of fairly obvious office romances taking place.

Kathryn believes that she ought to notify someone of what has happened, but feels again that she might be just making too much of the problem. She recalls a difficult situation at university when a female student complained of harassment from male students in a computer lab and her embarrassment when no action was taken against the students. At the time Kathryn and her female friends felt very little sympathy with the girl, who often made fun of Kathryn and her 'nerdy' friends. She also recalls her parents' reaction – that the girl should have found some other way to manage the situation without taking the matter to the authorities. Although Kathryn did not experience any such harassment during her IT studies, she has noticed that she attracts more attention from men since she started working. She assumes that it is because she now has enough money to dress smartly and pay more attention to her appearance.

A week after the lunch, Kathryn is approached by Stephen, her Harrison Consulting project manager, with an excellent career opportunity: Doug has requested that Kathryn become a consultant for his group and transfer to his quality assurance team. This would ensure additional contract dollars for Harrison Consulting and potentially earn Kathryn an early promotion for winning client work. Stephen is very keen that Kathryn should take up this position and assumes that she will be very pleased to do so. Yet, Kathryn feels uncomfortable with the thought of reporting to and working directly with Doug. She has kept copies of the emails that Doug sent her and she now wishes that she had spoken to Stephen.

Should Kathryn take the position with Doug? Or should she talk to Stephen? If yes, how much should she tell Stephen about the situation? What could Kathryn have done differently?

Appendix 2: Bommer et al Model of Ethical and Unethical Decision Making, and Thomas-Kilman conflict management strategies.

Summary of Bommer et al. (1987) Model of Ethical and Unethical Decision Making

Perception of Personal, Professional, Work, Government/Legal, Social environments as well as Individual attributes influence the decision process resulting in ethical or unethical behaviour. These include the following elements listed in the original Bommer, Gratto, Gravender and Tuttle (1987) model as well as 'gender', which we included to each element to remind the students of the fundamental aims of the course.

Personal Environment: Peer group, Family, Gender

Professional Environment: Codes of conduct, Licensing requirements, Professional meetings, Gender

Work Environment: Corporate goals, Stated policy, Corporate culture, Gender

Government/legal Environment: Legislation, Administrative agencies, Judicial system, Gender

Social Environment: Religious values, Humanistic values, Cultural values, Societal values, Gender

Individual Attributes: Moral level, Personal goals, Motivation, Position, Life Experiences, Personality, Gender

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Recognising Conflict Management Behaviour (Thomas and Kilman, 1974)

Style/Strategy	Behaviour
Avoiding	Ignoring conflict, leaving, stalling, delaying decisions.
Compromising	Negotiating, trading, bargaining.
Competing	Forcing agreement, using power, creating divisions, rivalry and win-lose solutions.
Accommodating	Giving in, obeying, complying.
Collaborating	Facing problems, sharing ideas, viewing conflict as useful, finding win-win solutions.